R,D ARMY &A

- RESEARCH
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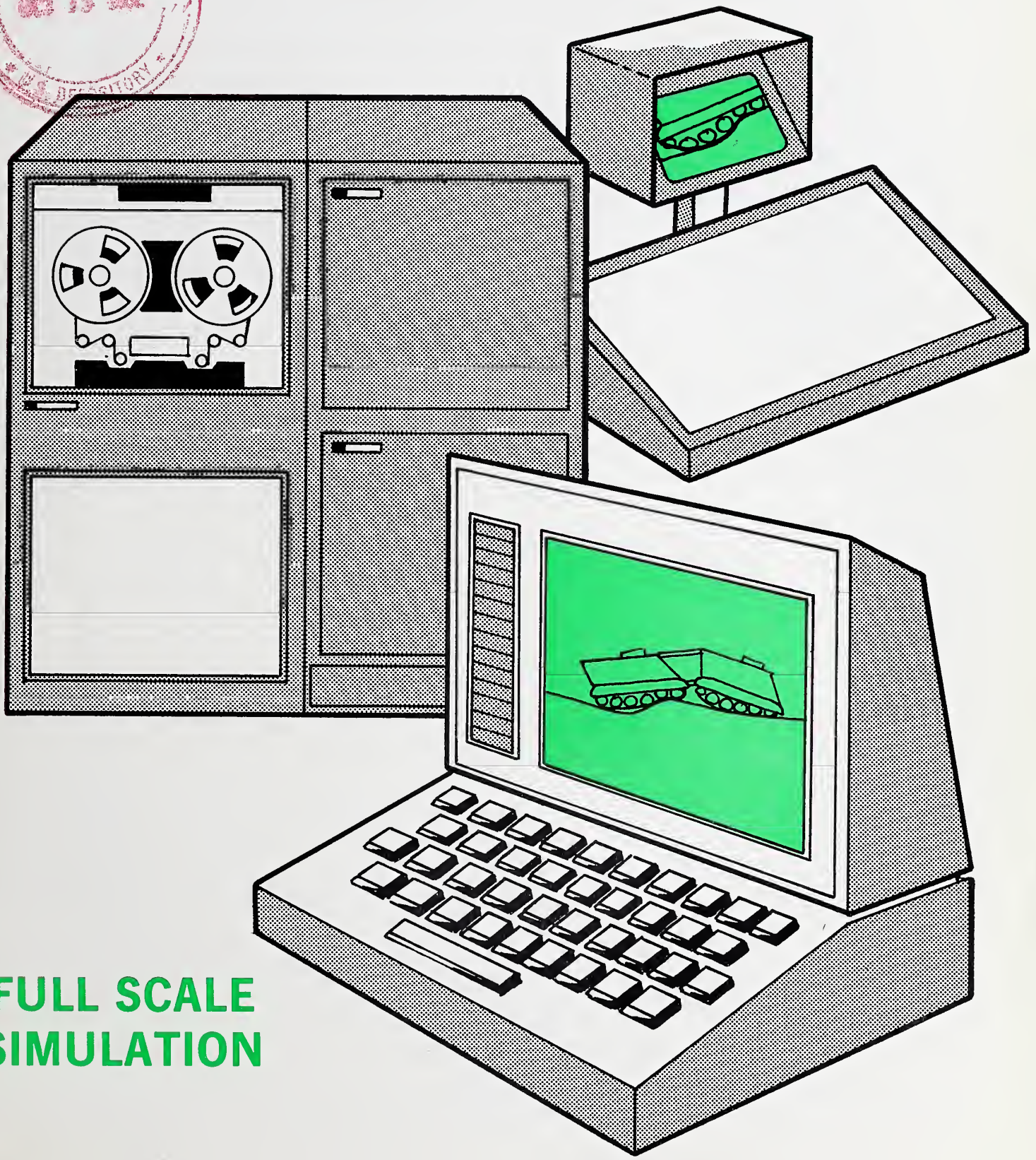
SEPTEMBER - OCTOBER 1982



FULL SCALE SIMULATION

ARMY R,D&A

Vol. 23 No. 5 SEPTEMBER-OCTOBER 1982

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ABOUT THE COVER:

Shown on the front cover are some of the electronic resources used by the Army Tank-Automotive Command in conducting full-scale simulations in support of new combat vehicle technology. Displayed on the back cover is the 2-inch cast bronze medallion that will be presented to 77 Army scientists/engineers for R&D Achievements.

FEATURES

DEPARTMENTS

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Purpose: To improve informal communication among all segments of the Army scientific community and other government R, D&A agencies; to further understanding of Army R, D&A progress, problem areas and program planning, to stimulate more closely integrated and coordinated effort among Army R, D&A activities; to express views of leaders, as pertinent to their responsibilities, and to keep personnel informed on matters germane to their welfare and pride of service.

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Full-Scale Simulation

By Dr. Ronald R. Beck

One of the missions of the U.S. Army Tank-Automotive Command's Tank-Automotive Concepts Laboratory is to perform basic and applied research aimed at the improvement of cross-country mobility and fire-on-the-move capability of existing and future Army vehicles. To fulfill this mission requirement, the interaction of dynamics of terrain-vehicle systems, vehicle-weapon systems, and man-vehicle-weapon systems are investigated.

Information gained from these research activities is used to: formulate, design and test novel, highly mobile combat vehicles and component concepts, and derive, develop and validate comprehensive analytical methods for predicting combat vehicle performance and for the evaluation of future weapon system concepts. Thus, research and development at TACOM to improve the off-road mobility and fire power of combat vehicles has led to the investigation of highly different and complex weapons systems concepts.

Current interest in the development of lightweight combat vehicles carrying high-impulse weapons and having cross-country mobility comparable to the 60-ton main battle tank has generated several technical problems. Foremost of these are the cross-country chassis/turret interaction dynamics and firing platform stability trade-offs which must be made to obtain a balanced chassis/turret design resulting in optimum dynamic response to the total system.

The systems being considered weigh approximately 20 tons and mount a high-impulse, kinetic-energy tank cannon with burst fire capability and fire-on-the-move ability. Recent examples are the Armored Combat Vehicle Technology, Light Armored Vehicle, and Mobile Protected Gun System programs.

The Army's goal of achieving a high level of mobility and firepower with a vehicle weighing approximately 20 tons is leading to important trade-offs in vehicle system dynamics. Design characteristics and performance of suspension subsystems, gun/turret drive subsystems and weapon recoil mechanisms are interacting far more than in the past and should be considered synergistically.

Primary factors affecting the kinetics of a combat vehicle are the inertially induced forces and loads which arise while traveling cross-country and those resulting from the kinetic-energy

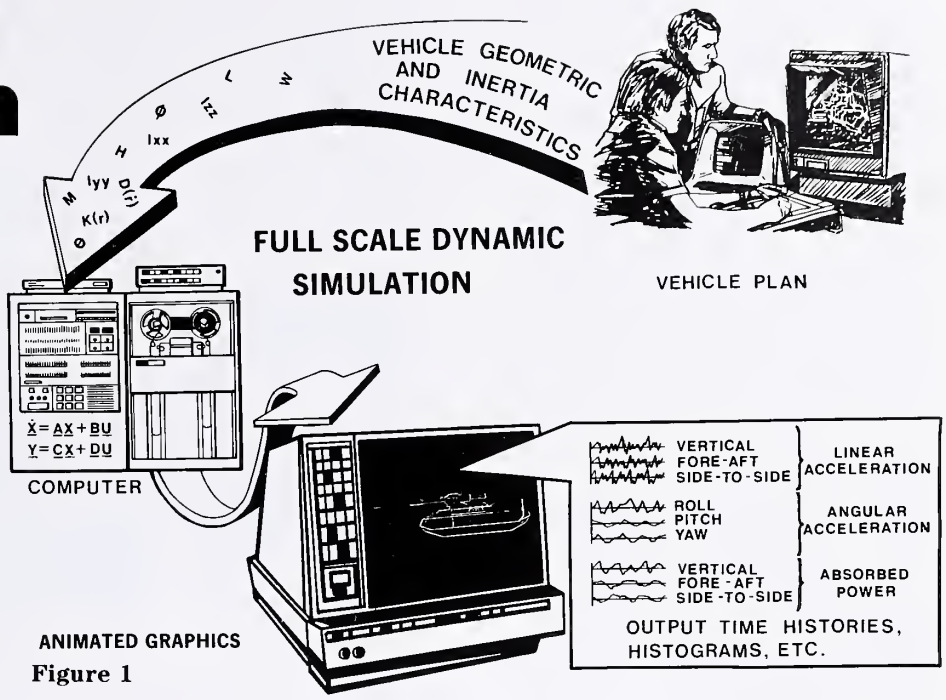

Figure 1

transfer from the turret to chassis when firing the main weapon.

While stiffening the suspension improves weapon stability when firing from a stationary position, it degrades ride and hence mobility of the vehicular system and leads to a more severe environment against which the weapon stabilization system must compensate during fire-on-the-move capability, but may lead to unacceptable performance in stationary burst fire.

Additionally, softening the suspension leads to substantially increased vehicle dynamic response to firing, hence to secondary recoil effects that must be accounted for in recoil mechanism design. It is clear that vehicle suspension, gun-turret drive subsystems and recoil mechanisms must be designed for an integrated system. A tool is needed for determining dynamic interactions of these three and other subsystems of a combat vehicle.

The classical approach to the dynamic analysis and design of these and other complex systems has been to utilize a variety of subsystem and/or simplified analysis techniques to design the identifiable subsystem as separate entities.

The interactive effects were estimations based on certain standard kinds of functional forms, i.e., sinusoidal, step, ramp, steady state, linearized, etc. It was not feasible to evaluate the final system behavior until the system was actually constructed and tested, usually in prototype form.

It was not unusual to find that the complete system behavior was in many respects quite different from that predicted. This was due to a variety of causes such as: nonlinear behavior, interactive effects which were different than anticipated, and secondary effects which had been neglected.

The recent dramatic increase in available computing capacity permits development of the capability to simulate entire systems in substantial detail. Requirements for this approach to be feasible for use by designers are:

- Development of a user oriented general purpose computer program, capable of handling large scale systems;
- Development of adequate modeling techniques which will allow a large range of commonly encountered elements to be interconnected by users who have little familiarity with the details of the computer program;
- Substantial validation of simulation results by carefully controlled experiments. This is required in order to develop confidence in the approach.

Two complementary basic and applied research efforts pursued by TACOM are culminating into the development of such a total system design. This first is a large-scale, computer-aided analysis methodology (Figure 1) in which a general purpose computer code is used to generate the system equations of motion, numerically solve the equations of motion of the system, and create animated graphics output that displays to the engineer the performance of a system. The second development is a full-scale system simulation (Figure 2) in a full-scale vehicle system dynamic simulation laboratory, which tracked and wheeled vehicles can be instru-

mented and exercised in a controlled laboratory development.

The computer-aided analysis methodology initiated by TACOM and now supported by TACOM, ARRADCOM and ARO is providing a capability for mechanical systems dynamic analysis that parallels the finite element method for structural analysis and design.

The Center for Computer Aided Design at the University of Iowa initiated development of a computer code called the Dynamic Analysis and Designs System (DADS) in 1977. Since 1978, TACOM has supported the expansion of this effort, with still further expansion being supported by ARRADCOM for armament dynamics.

DADS methodology allows the engineer to specify data defining his system in engineering terms. It has been structured to allow models to be made up of an interconnected collection of rigid bodies, standard kinematic joints (such as spherical joints, universal joints, cylinderical joint, translation joints, etc.) and complaint elements that represents springs, dampers (shock absorbers) and actuators. Provision has also been made to allow the engineer to input nonstandard element and servo control system dynamics equations.

The DADS modeling method then automatically assembles and solves the governing differential equations of motion and constraints. The output is the time history of position, velocity, and acceleration of all parts making up the system and the forces of interaction between components of the system.

Development now underway in the DADS code will allow for incorporation of feedback control subsystems, elastic deformation of bodies making up the system, friction, track, cams, and numerous other interdisciplinary effects that occur in realistic vehicle systems.

Auxiliary computer software and computer graphics hardware have also been developed to produce an animated display of the performance of a complete vehicle system, to aid the engineer's understanding of its behavior in a qualitative as well as quantitative way.

Complementing the DADS computer simulation methodology is a full-scale dynamic testing simulation laboratory at TACOM. In this facility, completed combat vehicles can be mounted on hydraulic actuators which provide group disturbance inputs to the chassis as a function of cross-country terrain roughness and vehicle speed.

The laboratory has both digital and hybrid computers. Computers are used for DADS simulation studies, experiment control, data analysis and hardware-in-the-loop test simulation. The High Mobility/Agility Test Vehicle and High Survivability Test Vehicle-Lightweight systems and instrumentation vans are presently being used to support DADS model validation studies, current TACOM and MPG research objectives and component hardware-in-the-loop testing at the vehicle system level. Additionally, there is a seat simulation facility in the laboratory available for man-in-the-loop investigations in support of man-machine interaction research.

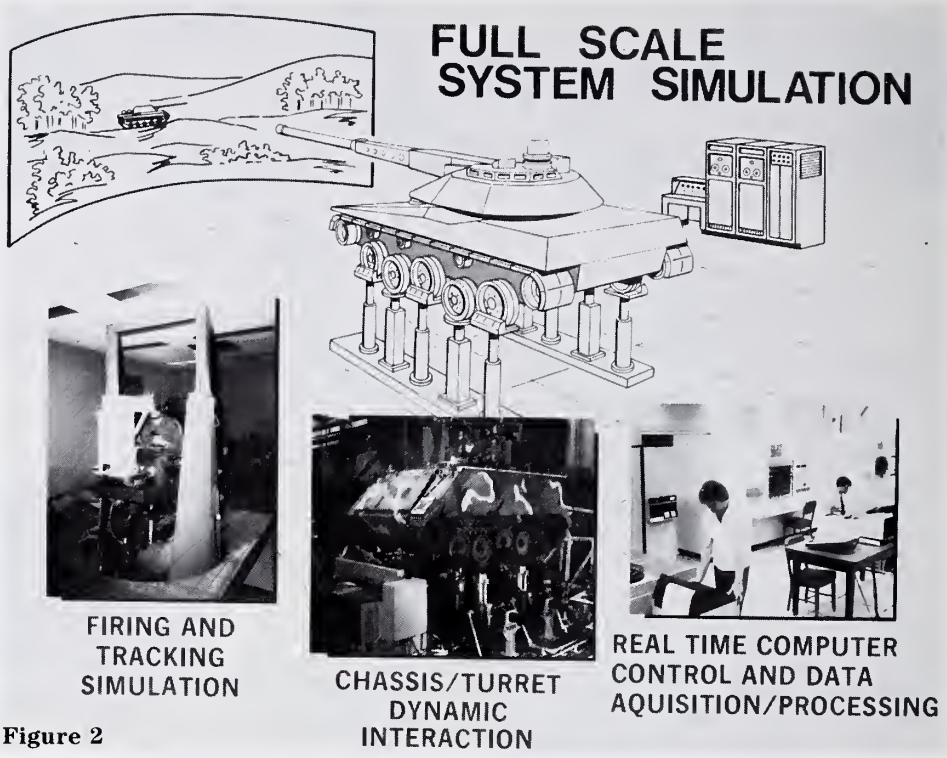

Figure 2

The seat simulator can be reconfigured to accommodate different gunner controls, tracking devices and displays in support of gunner fire-on-the-move investigations. This unique facility is one of the mechanisms for testing, evaluating and demonstrating at the vehicle system level the benefits to be derived from new theories and component hardware developments.

Future plans include installation of AMSAA's Moving Target Simulator methodology and installation and testing of the TACOM/HEL Fire Control Research System developed by Delco.

Full-scale simulation is therefore the culmination of an analytical and testing methodology to evaluate, screen and support integration of new technology into combat vehicle concepts. It is a new approach to the dynamic analysis, testing and design of complex systems.

Coordinated use of the DADS program, testing laboratories and vehicle test beds at TACOM could impact combat vehicle design in the following ways:

- A given design configuration will be evaluated with a fraction of the time and expense associated with construction and testing of a prototype;
- Critical design parameters will be identified by design sensitivity analyses and associated simulation results;
- Procedures will be implemented to identify the optimum system configuration according to any desired criterion of performance. (Cost can also be a part of the performance index.)

The DADS program and simulation labs have been demonstrated to be a feasible basis for this activity. Thus far, the DADS program and lab facilities have been employed to support several major programs such as the Armored Vehicle Technology, Light Armored Vehicle, MPGS, M109 Maxi-PIP Program and several TACOM in-house efforts.

DR. RONALD R. BECK is project engineer for the full-scale simulation research programs at the U.S. Army Tank-Automotive Command, in the Applied Research Function of the Tank-Automotive Concepts Laboratory. He holds BS, MS and PhD degrees in mechanical engineering and has 10 years experience relating to the dynamic and control analysis and testing of combat and tactical vehicle systems.

R&D Awards Recognize 77 for In-House Lab Efforts

U.S. Army R&D Achievement Awards will be presented to 77 Army in-house laboratory scientists and engineers, for 34 research projects that have advanced the capabilities of the U.S. Army and/or contributed to the national welfare during Calendar Year 1981.

Consisting of a wall plaque and a 2-inch cast-bronze medallion, the awards will be shared by 65 personnel attached to activities of the U.S. Army Materiel Development and Readiness Command, 9 with the U.S. Army Corps of Engineers, and 3 with the Office of The Surgeon General.

Recipients of the awards will be honored by Army R&D leaders, during the next few months, at the activities where they are employed.

Listed within their major commands, subcommands and/or installations, the award winners and excerpts from their nominations and citations follow.

U.S. ARMY MATERIEL DEVELOPMENT & READINESS COMMAND (DARCOM)

U.S. ARMY ARMANENT R&D COMMAND (ARRADCOM), Dover, NJ. Thirty-three ARRADCOM employees, representing headquarters and the four primary laboratory elements of the Command, will receive Army R&D Achievement Awards. The recipients were selected through 12 nominations—10 team efforts and 2 individual accomplishments.

A 3-man scientist/engineer team will receive the award for development of the first filmless, 3-dimensional, automated inspection system for high-explosive artillery shell. Implementation of this system is expected to eliminate reliance on x-ray film and human interpretation and will therefore increase safety and reliability of ammunition.

Members of this team are *Messrs. Emmett G. Barnes, Joseph M. Argento, George P. Drucker*, all of the Product Assurance Directorate at Dover, NJ.

Large Caliber Weapon Systems Laboratory (LCWSL)—A 2-man team was selected from a nomination submitted by the LCWSL.

Messrs. Jack Connors and *Bernard Mack* will be recognized for their work associated with the conceptual design and exploratory development of automatic artillery weapon control, including position location and on-board technical fire control computerization for self-propelled howitzers.

Development of this equipment now creates the potential capability to emplace, set-up and lay self-propelled artillery much more accurately and faster than any fielded system, or other developmental system known to exist in the free world today.

Connors is with the LCWSL; Mack is employed by the Fire Control & Small Caliber Weapon Systems Laboratory. Both labs are located at Dover, NJ.

An individual award will go to *Dr. Frank J. Owens* for his pioneering research into shock-induced chemical reactions in organic and inorganic solids, which showed that shock-induced reactions can be a result of the non-equilibrium conditions induced by the shock and because of this the laws governing normal reactions can be violate. This allows the possibility to synthetize new materials that cannot be made by conventional chemical means.

Fire Control & Small Caliber Weapon Systems Laboratory (FC&SCWSL)—Three team awards and an individual award will recognize achievements of 12 ARRADCOM employees for work conducted at the FC&SCWSL located at headquarters.

A 6-person team of engineers—*Mr. Edward T. Malatesta* of the FC&SCWSL, and *Mr. Richard D. Kirkendall, Dr. William H. Drysdale, Mrs. Louise Kokinakis, Mr. Chester L. Grabarek* and *Mr. Fred J. Brandon*, of the Ballistic Research Lab, will receive awards.

The team is commended for conceptualization, design and development of an improved kinetic energy, armor-piercing cartridge for use in the main armament for the Infantry and Cavalry Fighting Vehicles.

This new cartridge will increase the defeat range capability of the U.S. fighting vehicles against enemy light armor and insure that these fighting vehicles will have sufficient capability against the future predicted threats.

Dr. Jeffrey Waldman, Mr. Donald T. Rorabaugh and *Mr. Mohan Kumar*, from the FC&SCWSL, combined their talents to develop two innovative thermal mechanical processing treatments, termed Intermediate Thermal Mechanical Treatment and Final Thermal Mechanical Treatment, and two new powder metallurgy alloys, which make possible the production of high-strength aluminum alloys having superior combinations of strength, ductility and toughness properties.

Messrs. Bruce W. Brodman and *Michael P. Devine* were selected to receive awards for their basic research work in new high energy materials for propellant formulations.

The great potential of nitramines for increasing the volumetric impetus of propellant has not been fully realized because of combustion problems when the nitramine is present in a crystalline state. Brodman and Devine have developed a new complex between nitrocellulose and nitramines, wherein the materials are bonded on a molecular level, thus precluding the presence of crystalline nitramine.

An R&D award will be given to a metallurgist, *Mr. Fred Witt*, for his efforts that produced a uniquely configured computerized x-ray machine that is capable of assessing the suitability of metals where special directional properties are needed to match the directional requirements of their intended application.

It is currently being used to predict the armor penetration effectiveness of some antitank devices and has been used recently to gain greater insight into the metal-forming qualities of candidate metals used in cartridge-case production.

Chemical Systems Laboratory (CSL)—Four awards will go to ARRADCOM personnel at the CSL, Aberdeen Proving Ground (APG), MD: Two 3-man team awards for research in high-performance liquid chromatography, and for a decision tree for design of solid-state detection reactions; a 2-man team for discovery of new flight instability created by viscous liquid payloads; and an individual award for contributions in molecular interactions in atmospheric water vapor.

Dr. Paul C. Bossle, Mr. John J. Martin, and *Dr. Emory W. Sarver* were cited for scientific achievement in using an enhancement technique for analysis of sulfur mustards by high-performance liquid chromatography. This achievement was made possible by the ability to facilely convert these UV insensitive sesicant agents into highly detectable UV absorbing phenylsulfonylsulfilimine derivitives.

In addition, the major decomposition byproducts can be analyzed along with the sulfur mustards by this technique. These compounds, prior to this achievement, were difficult to analyze in aqueous matrices such as natural waters and waste streams.

The decision tree formulated by the second 3-man team, *Mr. William P. Ashman, Mr. James H. Lewis,* and *Dr. Edward J. Poziomek*, allows a prediction of which compounds can be detected by formulation of an association complex in the solid-state with derivitives of a class of compound termed 2-diphenylacetyl-1,3-indandione imines.

The finding will serve as an excellent model in designing solid-state detection reactions and forms a basis for many potential advances in this area.

Dr. William D'Amico of the Ballistic Research Lab at APG, and *Mr. Miles C. Miller* of CSL, are recognized for their work involving experimental analysis of the behavior of projectiles containing liquid payloads. During their investigations, they discovered a new and fun-

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R&D Achievement Award Winners

U.S. ARMY ARMAMENT R&D COMMAND, Dover, NJ—(1) Joseph M. Argento, George P. Drucker, Emmett G. Barnes. (2) Bernard Mack, Jack Connors. (3) Dr. Frank J. Owens. (4) Back row: Fred J. Brandon, Dr. William H. Drysdale, Richard D. Kirkendall. Front row: Chester L. Brabarek, Mrs. Louise Kokinkas, Edward T. Malatesta. (5) Donald T. Rorabaugh, Dr. Jeffrey Waldman, Mohan Kumar. (6) Bruce W. Brodman, Michael P. Devine. (7) Fred Witt. (8) John J. Martin, Dr. Paul C. Bossle, Dr. Emory W. Sarver. (9) William P. Ashman. (10) James H. Lewis. (11) Dr. Edward J. Poziomek.

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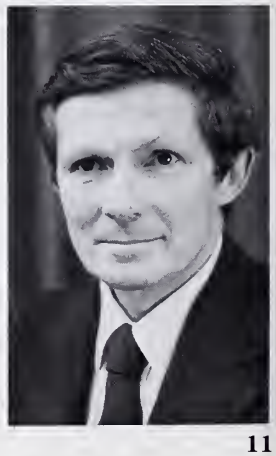

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damentally different flight instability produced by highly viscous liquid fills.

Their achievement represents a significant advance in scientific knowledge related to the flight characteristics of projectiles and is expected to strongly influence the design of both chemical and improved smoke obscurant munitions for the Armed Services.

CSL's individual award will recognize *Mr. Hugh R. Carlon* for his innovative research leading to the understanding of molecular clustering phenomena in atmospheric water vapor.

As a result of this work, substantial improvements in chemical development programs have resulted, and new contributions have been made to the basic scientific literature of radiative transfer, cloud nucleation and climatology.

Ballistic Research Laboratory (BRL)—Two 3-man team awards will be presented to ARRADCOM personnel at BRL, APG, MD. *Dr. William S. de Rosset* and *Messrs. Konrad Frank* and *Thomas A. Havel* will be honored for their contribution to the development of a set of international targets for the evaluation of antiarmor systems. These targets represent possible future tank threats and are used for evaluating the penetration performance and lethality of nearly every antiarmor system in development in the U.S.

The targets were developed with three allied nations. The common use of these targets will improve the value of future data exchanges on antiarmor systems between the U.S. and her allies.

Drs. Donald Eccleshall, Clinton Hollandsworth and *Robert Kremens* have been recognized for an evaluation of a special project involving complex scientific and engineering problems. The work at BRL led to unequivocal findings which have a major impact on investment strategy for the project.

U.S. ARMY ELECTRONICS R&D COMMAND (ERADCOM), Adelphi, MD. Fifteen ERADCOM personnel will be honored by seven R&D awards for research conducted at ERADCOM headquarters and Harry Diamond Laboratories, Adelphi, MD; the Atmospheric Sciences Laboratory, White Sands Missile Range, NM; and the Night Vision & Electro-Optics Laboratory, Fort Belvoir, VA.

Combat Surveillance & Target Acquisition Lab (CSTAL) and Electronics Technology & Devices Lab (ET&DL)—Under a joint effort between the CSTAL and ET&DL, *Messrs. John Borowick* (CSTAL), *Richard A. Stern* and *Richard W. Babbitt* (ET&DL), have designed, fabricated, and measured antennas applicable to millimeter wave radars to be used in tanks, terminal homing weapons, and mini-RPVs.

Through the efforts of this completely in-house ERADCOM program, new antennas that provide realizable designs with low cost, light weight fabrication processes have been brought off the drawing board and into the practical hands-on development stage.

ET&DL researchers *Dr. Roger J. Malik* and *Messrs. Thomas R. AuCoin, Raymond L. Ross,* and *Robert O. Savage, Jr.*, will receive a team award in recognition of a major contribution to advancing the state-of-the-art of microwave/millimeter-wave transistors and mixer diodes. This innovative development, molecular beam epitaxy-formed planar doped barrier, has resulted in a new generic class of semi-conductor rectifying barriers in gallium arsenide.

The newly invented barrier offers higher cutoff frequency, variable barrier heights, lower noise, and opportunity for planar processing. As a result of this advance, subharmonically pumped single element mixers have been demonstrated for the first time. The impact upon cost and performance of lightweight, high-resolution radars will be considerable.

Another R&D award will go to ET&DL nominees *Messrs. M. Robert Miller, Richard P. Tuttle, Eliott Schlam,* for developing a radically new power-saving way of driving and matrix-addressing thin-film electroluminescent displays, which promises to revolutionize battlefield automation. The technique utilizes the capacitive nature of the TFEL device to recover and recycle the portion of the driving power that is ordinarily lost.

This results in interactive computer graphic and video displays that dissipate only a few watts and are very compact and low cost, allowing, for the first time, the fielding of such displays at all battlefield echelons, providing for what is now a missing link in the automated highly mobile distributed battlefield required for the 1990s.

Harry Diamond Laboratories (HDL)—A 2-man team award and two individual awards will honor research conducted at HDL, Adelphi, MD.

Dr. Tadeusz M. Drzewiecki and *Mr. R. Michael Phillippi* were selected on the basis of successful research efforts that led to development of a high-temperature sensor capable of contact temperature measurements approaching 3000° C. This conceptually simple sensor is highly reliable, very accurate and with the capability of precise temperature measurements to the extent that the National Bureau of Standards is considering it as a temperature standard.

The temperature sensing system has already demonstrated continuous accurate temperature readings of molten iron in an Army ammunition plant for over 5000 hours. This sensor system has a potential for reducing energy consumption and providing better product control, thus saving $M's in the process industry.

Mr. Robert S. Goodman will be commended for his superior technical and managerial achievements in directing development of the electronic time fuze for the Multiple Launch Rocket System.

According to his citation, "Under his leadership this precision electronic time fuze was successfully developed in an accelerated program. Despite time pressures for delivery of test fuzes to two competitive contractors during the Validation Phase and equally stringent time constraints in the Maturation Phase, this fuze has achieved a 100% proper score in 100 rounds fired."

Mr. Philip F. Ingersol was selected in recognition of his superior technical and managerial achievement in directing the artillery-delivered Unattended Expendable Jammer Program. "Under his direction, a unique system for deploying jammers from artillery projectiles to form a prescribed pattern on the ground has been demonstrated and jammer designs that survive gun firing have been developed.

Atmospheric Sciences Laboratory (ASL)—*Dr. Douglas R. Brown* is recognized for development of a microwave/millimeter wave atmospheric propagation model that condenses a large amount of theoretical and experimental information into a simple user-oriented computer code.

His work at ASL, White Sands Missile Range, NM, has resulted in a significantly increased Army capability to determine and assess microwave/millimeter systems performance in an adverse weather environment.

U.S. ARMY AVIATION R&D COMMAND (AVRADCOM), St. Louis, MO. Seven AVRADCOM scientists/engineers will be honored through a 5-person team award and two individual awards.

Research and Technology Laboratories (RTL)—The team award will go to *Mr. H. Andrew Morse, Dr. Fredric H. Schmitz, Mr. Donald A. Boxwell, Ms. Georgene H. Laub,* and *Mr. Robert E. George*, all employed at RTL, located at NASA Ames Research Center, CA.

The group was cited in recognition of the outstanding contributions to the understanding of the physical phenomena involved in the aerodynamically generated noise from helicopter

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Army R&D Achievement Award Winners

U.S. ARMY ARMAMENT R&D COMMAND, Dover, NJ—(1) Dr. William D'Amico, Miles C. Miller. (2) Hugh R. Carlon. (3) Dr. William S. deRosset, Thomas A. Havel, Konrad Frank. (4) Drs. Donald Eccleshall, Clinton Hollandsworth, Robert Kremens. U.S. ARMY ELECTRONICS R&D COMMAND, Adelphi, MD—(5) John Borowick, Richard A. Stern, Richard W. Babbitt. (6) Dr. Roger J. Malik, Thomas R. AuCoin, Robert O. Savage, Raymond L. Ross. (7) M. Robert Miller, Eliott Schlam, Richard P. Tuttle. (8) R. Michael Phillippi, Dr. Tadeusz M. Drzewiecki. (9) Robert S. Goodman.

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rotors. The experimental techniques, the analytical procedures, and the mathematical models represent a significant advance in rotary wing technology as their results will influence the design of all future helicopter rotors.

Mr. Charles M. Pedriani, an aerospace engineer in the Safety and Survivability Technical Area of the Applied Technology Laboratory, RTL, will receive an award for contributions to Army aviation in the form of an advanced, generic fuel fire suppression system capable of essentially eliminating fuel fires in Army helicopters.

Pedriani is credited with pioneering research to establish and quantify in engineering terms the fire hazards facing combat helicopters and investigated numerous protective measures. Extensive design and analysis activities were conducted to integrate the best fire stopping techniques into Army helicopters in a manner to provide complete effectiveness, low weight, and minimal operational impact.

The major components were designed to be generic in nature so that the same basic components can be used in all Army helicopters.

Avionics R&D Activity (AVRADA) —*Messrs. Arthur W. Lindberg* and *Mitchell S. Mayer* earned an R&D Achievement Award for their work involving the scientific evolution of a vastly improved system design and testing philosophy for airborne audio communications subsystems.

Their research at AVRADA, located at Fort Monmouth, NJ, "represents a giant step forward in improving the Army's airmobile capability in the immediate future, as evidenced by its early fielding in Army applications, concomitant with its demonstration of potential for tri-service use."

U.S. ARMY MOBILITY EQUIPMENT R&D COMMAND (MERADCOM), Fort Belvoir, VA. *Messrs. Fred L. Lafferman* and *Stanley F. Koutek* and *Ms. Virginia S. Estes* will receive awards for their development of a new Chemical Agent Resistant Coating for Army tactical materiel and for demonstrating the technical and operational feasibility of this coating for Army applications. All three are with the Material Technology Laboratory at MERADCOM.

"This new formulation provides for retention of camouflage antidetection capabilities, removal of lead and lead-chromates to meet Occupational Safety Health Administration requirements, reduction of valatile organic compounds to meet Clean Air Act requirements, and the capability for rapid chemical agent decontamination."

U.S. ARMY MATERIALS & MECHANICS RESEARCH CENTER (AMMRC), Watertown, MA. AMMRC employees will share a 4-man team award for development of a diffusion-bonded rotating band on titanium-base projectiles, and an individual award for development of advanced computer-controlled ultrasonic instrumentation.

Mr. Jacob Greenspan, MAJ David S. Kiefer, and *Messrs. Russell G. Hardy* and *James T. Garvin* earned the group award for conceiving and successfully carrying out research and development leading to establishment of special techniques to attach rotating bands of conventional copper or copper alloy to large-caliber projectiles of high-performance titanium alloy.

This achievement, in support of the Army XM785 Nuclear Projectile Development Program, consists of development of both the processing and the metallurgy for attaching such rotating bands unconventionally by a diffusion bond, with such integrity as to function satisfactorily under the severe stresses of the gun-launch environment.

Dr. James M. Smith will receive an Army R&D Achievement Award for designing, fabricating and testing an advanced ultrasonic testing instrument that brings together several technologies to produce a high-speed nondestructive testing instrument, which has reduced the inspection time for certain products such as artillery shell rotating bands by about a factor of ten.

The equipment is fully automatic and does not require a trained operator to make decisions on the acceptability of the part during inspection.

U.S. ARMY NATICK R&D LABS (NLABS), Natick, MA. *Mr. Alvin O. Ramsley* will be honored for his ingenuity, technical ability, resourcefulness and dedication in the development of the broad band Woodland pattern camouflage system for battledress clothing, a major advance in surveillance protection for the soldier.

The broad band Woodland pattern camouflage provides improved protection over the full range of human vision, and by extension into the near infrared, patterned camouflage has for the first time been achieved in a practical combat uniform to provide protection against advanced night viewing devices.

U.S. ARMY CORPS OF ENGINEERS

Military RDT&E (primarily 6.1 & 6.2) and civil works R&E have earned the Corps of Engineers 5 R&D Achievement Awards (9 researchers) for projects at the Waterways Experiment Station; the Construction Engineering Research Laboratory; and the Cold Regions Research and Engineering Laboratory.

U.S. ARMY ENGINEER WATERWAYS EXPERIMENT STATION (WES), Vicksburg, MS. *Messrs. Thomas W. Richardson* and *Ernest C. McNair, Jr.*, have been selected to receive awards for developing an engineering approach to sand bypassing and developing engineering design criteria for sand bypassing systems using jet pumps.

The Army's technical capability was materially improved since a systematic approach is now available to address one of the nation's problems, that of bypassing sand to preserve beaches and to maintain harbor channels.

Messrs. Lewis L. Link, Jr., and *John G. Collins* provided outstanding leadership and management in the Corps of Engineers Military Hydrology Research Program.

Their efforts have resulted in development of new Army capabilities for water supply location and assessment in arid regions. Included in their research was the assessment of water supply materiel requirements in selected arid regions of the world, near real-time streamflow forecast procedures for tactical operations, and the utilization of advanced radar and satellite technology into intelligence data acquisition for hydrologic forecasts.

These products are being integrated into the operational force units, such as the Rapid Deployment Joint Task Force.

U.S. ARMY CONSTRUCTION ENGINEERING RESEARCH LABORATORY (CERL), Champaign, IL. *Ms. Janet Spoonamore*, and *Messrs. Kenneth Crawford* and *Dale Herron* have been selected for their joint efforts in the development of Concept CAEDS-a Computer-Aided Engineering and Architectural Design System.

The computer system recently was tested in architectural and engineering design of over 100 construction projects in the Army. It is reported that designs cost savings and increased quality can result from this achievement.

Dr. Mohamed Y. Shahin was selected to receive an award for his efforts in developing a systematical methodology for maintenance management facilities (PAVER). Designed initially for pavements, PAVER has set the pattern and opened the way for development of similar systems for roofing, railroads, buildings, utilities, and others.

According to his citation, this system, which has generated worldwide interest, could result in savings of 50% and provide better maintenance management.

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Army R&D Achievement Award Winners

U.S. ARMY ELECTRONICS R&D COMMAND, Adelphi, MD—(1) Philip F. Ingersol. (2) Dr. Douglas R. Brown. U.S. ARMY AVIATION R&D COMMAND, St. Louis, MO—(3) Standing: Robert E. George, Donald A. Boxwell, Dr. Fredric H. Schmitz. Seated: H. Andrew Morse, Ms. Georgene H. Laub. (4) Charles M. Pedriani. (5) Arthur W. Lindberg. (6) Mitchell S. Mayer. U.S. ARMY MOBILITY EQUIPMENT R&D COMMAND, Ft. Belvoir, VA—(7) Fred L. Lafferman. (8) Stanley F. Koutek. (9) Ms. Virginia S. Estes. U.S. ARMY MATERIALS AND MECHANICS RESEARCH CENTER, Watertown, MA—(1) Jacob Greenspan. (11) MAJ David S. Kiefer. (12) Russell G. Hardy. (13) James T. Garvin. (14) Dr. James M. Smith. U.S. ARMY NATICK R&D LABS, Natick, MA—(15) Alvin O. Ramsley.

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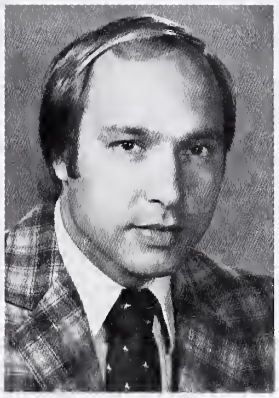

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U.S. ARMY ENGINEER WATERWAYS EXPERIMENT STATION, Vicksburg, MS—(1) Thomas W. Richardson. (2) Ernest C. McNair, Jr. (3) Lewis L. Link, Jr. (4) John G. Collins. U.S. ARMY CONSTRUCTION ENGINEERING RESEARCH LABORATORY, Champaign, IL—(5) Dale Herron, Kenneth Crawford, Ms. Janet Spoonamore. (6) Dr. Mohamed Y. Shahin. U.S. ARMY COLD REGIONS RESEARCH AND ENGINEERING LABORATORY, Hanover, NH—(7) Dr. George D. Ashton.

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U.S. ARMY COLD REGIONS RESEARCH AND ENGINEERING LABORATORY, Hanover, NH. *Dr. George D. Ashton* was recognized for his outstanding scientific research on thermal control and prevention of ice in rivers and lakes. His research constitutes a major scientific breakthrough and establishes a technological basis for solving hydraulic engineering problems dealing with ice suppression on rivers and lakes.

As a result of his developing new knowledge and technology of thermal control and suppression of ice growth, the capability to minimize economic penalties of river- and lake-ice-related problems of the Corps and the nation has been significantly increased.

OFFICE OF THE SURGEON GENERAL

Two nominations, involving 3 researchers, were selected to receive Army R&D Achievement Awards:

U.S. ARMY MEDICAL BIOENGINEERING R&D LABORATORY, (USAMBRDL), Fort Detrick, MD. Research chemists, *Drs. William H. Dennis, Jr.*, and *Elizabeth P. Burrows*, while using advanced analytical instrumentation (gas chromatography and mass spectrometry), were able to demonstrate that environmental pollutants being studied at the Aberdeen Proving Ground were artifacts of earlier, less sophisticated analytical technology, being used by other agencies.

These findings are significant because they will permit future studies of environmental fate and aquatic and mammalian toxicity testing to address the true problem.

U.S. ARMY MEDICAL RESEARCH INSTITUTE OF INFECTIOUS DISEASES (AMRIID), Fort Detrick, MD. *LTC George E. Lewis, Jr.*, will receive an award for his work at AMRIID. According to his citation, "His unequaled administrative proficiency and scientific knowledge in direction of highly productive research has culminated in the development of a vast store of botulism immune human plasma (the only supply in the free world) for treatment of botulism, and establishment of a national supply of botulinal toxoid."

"The innovative studies which he formulated, performed and skillfully analyzed, have received acclaim throughout the scientific community and established specific procedures for diagnosing, preventing, and treating human and animal botulism."

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U.S. ARMY MEDICAL BIOENGINEERING R&D LABORATORY, Fort Detrick, MD—(1) Dr. William H. Dennis, Jr. (2) Dr. Elizabeth P. Burrows. U.S. ARMY MEDICAL RESEARCH INSTITUTE OF INFECTIOUS DISEASES, Fort Detrick, MD—(3) LTC George E. Lewis, Jr.

New Directions in Embedded Computer Systems

By Peter Fonash and Robert Gamino

Ten years ago at a tri-service meeting on military computer systems, in Monterey, CA, the projected skyrocketing cost of military computer systems, especially computer software, held center stage. This article then is the first of several to report the status of current and planned efforts to overcome the cost and functional problems of embedded computer systems. For those who do not understand the term "embedded computer," an embedded computer system is an integrated hardware and software system which is a component of a larger system.

Many articles have been published on growing costs of computer systems, led by the increasing expense of and maintenance of computer software. Management has focused on this cost along with the functional problems in automated systems to provide appropriate direction.

Standardization in computer hardware and software provides increased reliability and maintainability resulting in these systems remaining in operation despite adverse battlefield conditions, and these efforts are being supported by top management in the Department of Defense and in each military service. Therefore, standardization in computer hardware architecture and software tools is evolving as perhaps the most significant contribution to automation improvement in the early 1980's.

Of particular interest at this time are the new software development tools and policy guidance. The tools include a new high order language and its support environment, for software development, and DOD policy guidance direction for project managers.

Ada is a modern high order computer language which will become the standard language to translate computer system requirements into DOD embedded computer applications. The Ada program extends beyond higher order language standardization to incorporate modern software engineering practices in new development support tools for Ada programming support environments (APSE) to provide life cycle support for application software.

Annual DOD computer software costs are measured in the billions of dollars. And, considering inflation and increased applications of computers to new functions, software will become an even more substantial portion of the DOD budget. The DOD recognizes that use of modern software development practices, supported by a common high order language and a modern programming support environment, will provide increases in productivity and quality control required to control the cost and improve the reliability of software.

Since 1975, embedded computer software has been written in many different computer oriented assembly languages and in a diversity of computer independent high order languages (e.g. Fortran). The high order languages (HOL) being used did not support modern software practices or techniques and these HOL were ill-suited to embedded computer applications for many reasons; the most prominent being real-time processing constraints of the HOL.

The assembly languages satisfied the real time constraints but programs written in assembly language were difficult to understand or maintain and were very hardware dependent. Accordingly, life-cycle cost of software written in assembly language was very high.

In 1975, the DOD started two initiatives aimed at reducing the life-cycle cost and improving the reliability of embedded computer software. First, DOD established the high order language working group (HOLWG) with representation from Army, Navy, Air Force, DCA, NSA and DARPA. The HOLWG was formed to identify DOD's requirements for computer programming languages and to evaluate existing languages and programming environments.

The second action taken by DOD was to limit the number of HOL which could be used for embedded computer software development and to require a waiver for using an assembly language in an embedded computer software development. This policy was formalized by issuing DODI 5000.31.

The HOLWG, in cooperation with DOD agencies, allied countries, industry and academia, coordinated the development of a comprehensive set of requirements for a standard HOL for embedded computer applications. These comprehensive requirements were published in June 1978 in a document named "STEELMAN" and existing HOLS were formally evaluated against these requirements.

An analysis determined that no existing language was sufficiently powerful to serve as the common language. The HOLWG managed a competitive international procurement for the design of a language to meet these requirements. It was decided to name the new language "Ada" in honor of Augusta Ada Byron, countess of Lovelace, (1815-1852), who is widely considered the first programmer because of her work with Charles Babbage. The language design was completed by CII-Honeywell Bull in July 1980, and is currently in the process of being approved as an American National Standards Institute (ANSI) Standard.

The Ada Joint Program Office (AJPO) was established to coordinate the joint services' efforts to introduce and adopt the Ada language, Ada programming support environments, and modern software engineering practices. The AJPO has the additional responsibility for maintaining the Ada language standard, for managing the development of life cycle software methodologies, for developing common-use training and education materials, for validating Ada compilers, and for developing Ada software tools which can meet the common needs of the services and other DOD agencies.

The AJPO is a small office comprised of a director, a technical director and three service deputy directors, one from each of the military departments, and reports to the Deputy Under Secretary of Defense for Research and Advanced Technology.

Ada is not simply a new language. It incorporates many of the features needed to support modern software engineering practices. Capabilities of Ada will be fully realized when a sophisticated APSE, complete with advanced development, maintenance, configuration control and management tools, are readily available and widely accepted by the software community.

Other advantages of Ada are that a standard HOL and a standard programming support environment will encourage capital investment in software tools, will permit reusable software, and will reduce training costs. These factors will contribute to increased programmer productivity and will improve the quality/maintainability of software produced by the programmers.

Although the DOD has two APSE developments underway, Ada programming support environments are expected to be developed independently by academia and industry. In order to increase compatibility between environments, the Navy has been tasked to lead a joint service review team to identify

and recommend conventions which will permit the transportability of tools among APSE.

It is anticipated that improved tools developed in the marketplace may be modified to conform with DOD interface standards and will be incorporated into DOD APSE. Close cooperation with the industrial sector, academia, and the international software community is required to encourage universal acceptance of the language and development of Ada products and tools in the marketplace.

The development of a broad Ada software community will be beneficial to the DOD and the U.S. computer industry. Efficient programming support environments and a large "pool" of Ada programs/programmers, in conjunction with the advantages inherent to the Ada language, has the potential of revolutionizing the software industry and will make Ada the universal HOL for all embedded computer applications. Military examples of embedded computer systems are: communication systems, command and control systems, on-board aircraft navigation systems, weapon control systems and other real-time control systems. Commercial examples of embedded computer systems are the computers in a car which control fuel usage and the control processor in a microwave oven.

To support this new language and standardization effort for military computers, the military has developed new policy guidance, and new regulations reflect this new direction. Army Regulation 70-1, "Army Research, Development, and Acquisition", is being revised from DOD to incorporate several changes in policies for systems acquisition. Of particular interest is the addition of guidance relating to battlefield automated systems (BAS).

The purpose of this guidance is to implement Department of Defense Directive (DODD) 5000.29, "Management of Computer Resources in Major Defense Systems", DODI 5000.31, "Interim List of DOD Approved High Order Programming Languages", in addition to information previously contained in AR 1000-1. This revision is especially timely in view of the increasing number of BAS entering the battlefield.

The HOL Ada, as specified in MIL-STD 181 5A, will be used for all new BAS software developments or major modifications beginning in January 1983. Configuration management procedures of MIL-S 52779A shall apply to these developments.

Waivers must be obtained by weapon system managers if other ISAs or HOLs are to be used. Economic and/or technical considerations will be the primary factors considered in the adjudication process. All requests for waiver will be submitted to HQ DARCOM (DRCDE-SB).

Army policy regarding BAS remains the same, i.e., that they will be managed within the context of the total system. In support of this policy, computer standardization in the form of a specified instruction set architecture (ISA) and high order programming language (HOL) has been adopted.

It is envisioned that these items will reduce unnecessary proliferation of computer types, thus providing commonality on the battlefield, and making new computer programs more transportable, enabling their development before hardware selection is made. Both are implemented in the proposed revision of AR 70-1.

This, the first in a series of planned articles on technology direction for embedded computer systems, covers software tools and policy guidance. The next article will include the projections for application programs in command and control systems and for computer hardware architecture in battlefield automated systems.

The authors of this article are engineers in the Battlefield Automation Management Division, DEA Directorate, HQ DARCOM.

DARCOM Reports on Acquisition Initiatives

A follow-up report on DARCOM implementation status of the Defense Acquisition Improvement Program (Carlucci) initiatives was issued recently by DARCOM Commander GEN Donald R. Keith. The report was provided to all personnel who had attended the Atlanta VIII executive seminar earlier in the year (see *Army RD&A Magazine*, May-June 1982).

GEN Keith stated at the outset of the report that some significant progress had been made, both in implementing the initiatives and in identifying areas that need concentrated effort. He indicated that a more comprehensive progress report was in the final stages of preparation and would be distributed shortly.

Some of the initiatives in which significant progress has been made, according to Keith, are as follows:

- *Multiyear Procurement* (Initiative 3). Several systems were approved for multiyear procurement and efforts are being pursued to identify additional systems and quantify savings that can be achieved by the multiyear approach. Additionally, the requirement for termination liability funding is seen as an inhibitor to this initiative and efforts are being made to reduce or remove this requirement.
- *Capital Investment* (Initiative 5). Progress has been made in several procurements by structuring them so that contractors were willing to invest their capital to provide facilities and/or improve productivity. This, however, is an area that requires much more action and innovative ideas from both DARCOM and industry.
- *Budget Funds for Technological Risk* (Initiative 11). A method has been developed to determine an amount attributable to the risk of transition from development to production.
- *Competition* (Initiative 32). A significant emphasis has been placed on competition by establishing goals, identifying a competition advocate at each major buying command, and examining each proposed acquisition to see if it is susceptible to competition either at the prime or subcontract level.

Army Approves Type Classification Of Lightweight 30MM Ammunition

The U.S. Army has approved the type classification of the lightweight 30mm ammunition developed under the auspices of the U.S. Army Armament Research and Development Command (ARRADCOM), Dover, NJ.

The ammunition has completed Army testing and is ready for production. Ammunition development was directed by the 30mm Project Manager's Office, a tenant organization of ARRADCOM.

Developed for the M230 chain gun on the Army's new AH-64 Attack Helicopter, the ammunition is interoperable with British and French weapons. A command official said the development represents a significant contribution to the attack helicopter's armament systems allowing self defense and attack of light armor while conserving the Hellfire missiles for the antitank role.

An initial production contract was awarded to Honeywell, Inc., Minneapolis, MN. Technical engineering support was provided by the Fire Control and Small Caliber Weapon Systems Laboratory's Armament Division. Concurrent with completion of development, the 30mm Project Manager's Office was terminated.

Energy Self-Sufficiency for the Airland Battle 2000 Thrust

By CPT William T. Broadwater and Mr. Maurice E. LePera

The emerging futuristic Airland 2000 Battle Concept emphasizes the use of alternate non-fossil fuels for propulsion and power generation systems. This concept is consistent with long range national energy objectives described in the National Energy Plan II, May 1979, the Energy Security Act, Public Law 96-294, 30 June 1980, the Army Energy Plan, August 1981, and the Army's energy goals and objectives put forth in the Army Energy R&D Plan, March 1981.

The increasing world demand for crude oil has been documented as well as the decreasing availability of high quality crudes. The strategic importance of developing energy resources to attain self-sufficiency becomes obvious when the following facts and projections by the Congressional Office of Technology Assessment are considered:

- There will be little or no increase in world oil production from conventional sources over current levels through the year 2000.
- U.S. production of crude oil from conventional sources are predicted to decline from the 1980 level of 10.2 million barrels per day to 4-7 in the year 2000.
- The U.S. possesses only 5 percent of the proven non-communist world crude oil reserves while consuming 30 percent of the world's energy.
- The dominance of the Middle East Region with over two-thirds of the non-communist world's proven oil reserves is well known.

Considering the political volatility of the Middle East region, where an overwhelming majority of the non-communist world's crude oil reserves are located, the increased dependence on foreign oil and the problems of securing the long lines of supplies from interruption, raises the question of our Armed Forces ability to carry out their mission in the event of a national emergency.

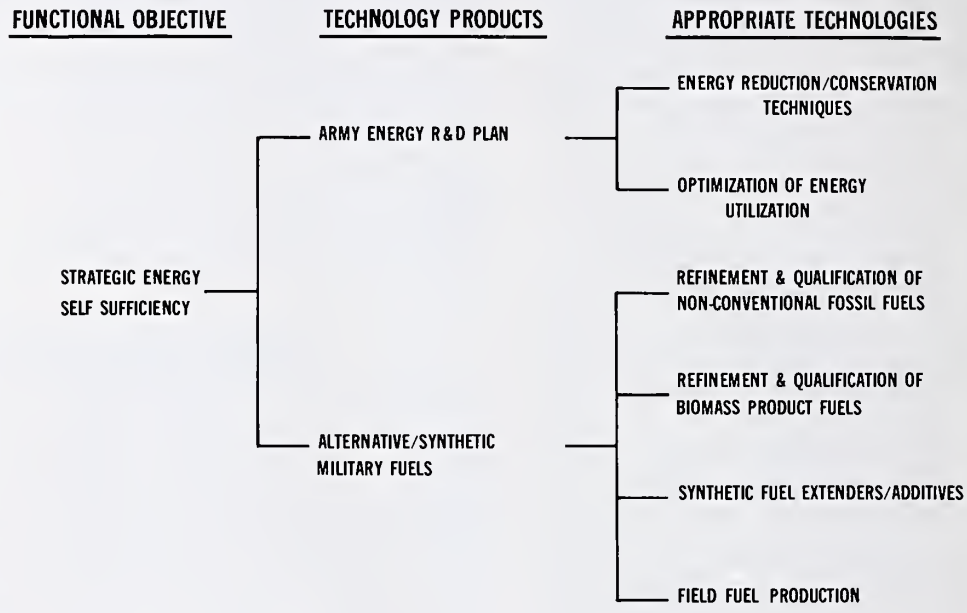


Figure 1

Therefore, the functional objective the Army must accomplish is strategic energy self-sufficiency. The U.S. Army Mobility Equipment Research & Development Command's (MERADCOM) role in accomplishing this objective is major and programs to support this effort include the Army Energy R&D Plan and the Alternate/Synthetic Fuels Program. The relationship of these programs and appropriate technologies to support the functional objective of strategic energy self-sufficiency is shown in Figure 1.

Army Energy R&D Plan

MERADCOM has been designated as lead laboratory for the Army Energy R&D Plan and has the responsibility to avoid duplication of R&D efforts within DARCOM and to recommend programs/projects that address specific energy-related technology gaps.

The plan, while serving as the primary management document for all Army energy R&D efforts, has an overall objective to ensure a cohesive, coordinated program leading toward stronger energy R&D that responds to existing and *future* Army requirements.

The plan concentrates on energy systems—facilities, power sources, and equipment, which make more efficient use of fuels and petroleum related products, reduce dependence on non-domestic fuels, and use less expensive and/or more plentiful renewable resources.

The Army Energy R&D Plan calls for:

- Reduced energy consumption by 35 percent by the year 2000. Actions include reduced energy consumption in mobility operations by 10 percent by FY 85 with zero growth to the year 2000; reduced energy consumption in facilities operations by 20 percent by FY 85 and 40 percent by the year 2000;

and expanded energy conservation information programs.

- The plan also calls for reduced dependence on nonrenewable and scarce fuels by the year 2000; a capability to use synthetic/alternate fuels for mobility; increased efficiency of mobility systems by 15 percent; a capability for facilities to use synthetic gas in place of natural gas; and reduced consumption of heating oil by seventy-five percent.
- Finally, the plan calls for a position of leadership in the pursuit of national energy reduction/conservation technology development. This applies to both the Army's mobility and facilities operations. MERADCOM's primary input will be to the Mobility Energy R&D Plan.

Having both the Army's Installation/Facilities Energy R&D Program and the Mobility Energy R&D Program in one overall management plan, allows for technology transfer between the two programs as well as coordination of energy conservation techniques.

Assessment activities, which are an integral part of the plan, provide the means to evaluate the viability of potential energy technologies for Army applications. By coordinating the assessment activities between the facilities program and the mobility program, the proper application of energy resources can be complementary rather than competitive. For example, ground tactical vehicles will be using liquid hydrocarbon energy sources of one form or another well into the 21st Century.

Use of nuclear power sources, solid fuels, and solar power sources for this application will, in all probability, not be technically feasible as mobility fuels for some time to come. However, these power sources will be viable for direct and/or indirect support of installation/facilities power source alternatives.

These alternate sources would not be competing with fuels for mobility applications and would therefore complement the mobility program by making available additional liquid hydrocarbon fuels for the mobility applications.

Alternative/Synthetic Military Fuels

Development of alternate/synthetic military fuels and their appropriate specifications to support "ground mobility weapons platforms", envisioned by the Airland Battle 2000 concept, will be achieved during the execution phase of the Army Energy R&D Plan. These efforts will lead to mobility fuels, lubricants, and fluids for military equipment which supports the goal of strategic energy self-sufficiency while at the same time meeting needed military characteristics, which are as follows:

- Survivability. Fuels and fluids must be designed to reduce the threat of fires produced by ballistic penetrations.
- Commonality. Products must have interchangeability and interoperability characteristics to comply with NATO standardization policies.
- Storage and environmental stability. Fuels, fluids, and lubricants must possess enhanced storage stability characteristics to minimize potential for deterioration/degradation.
- Multipurpose use. Products must be capable of being used in operations world-wide.
- Unique inhibitor requirements. The types of operational and environmental situations dictate the use of specific inhibitors. Examples are fuel system icing inhibitors, antioxidants, lubricity additives, biocides, static dissipator additives, rust preventatives, friction modifiers, etc.

Energy technology, sources, and utilization technologies are undergoing extreme changes which should continue over the next 30-40 years as the world readjusts to decreasing crude oil and increasing demands. Therefore, MERADCOM has developed an "Army Mobility Fuels Scenario," as a guide for future R&D planners to project fuel engine needs and to estimate, based on military considerations, priorities of fuel and engine development policies. The fuels scenario considers facts and projections presently accepted by the Department of Defense, Department of Energy, and commercial energy developers.

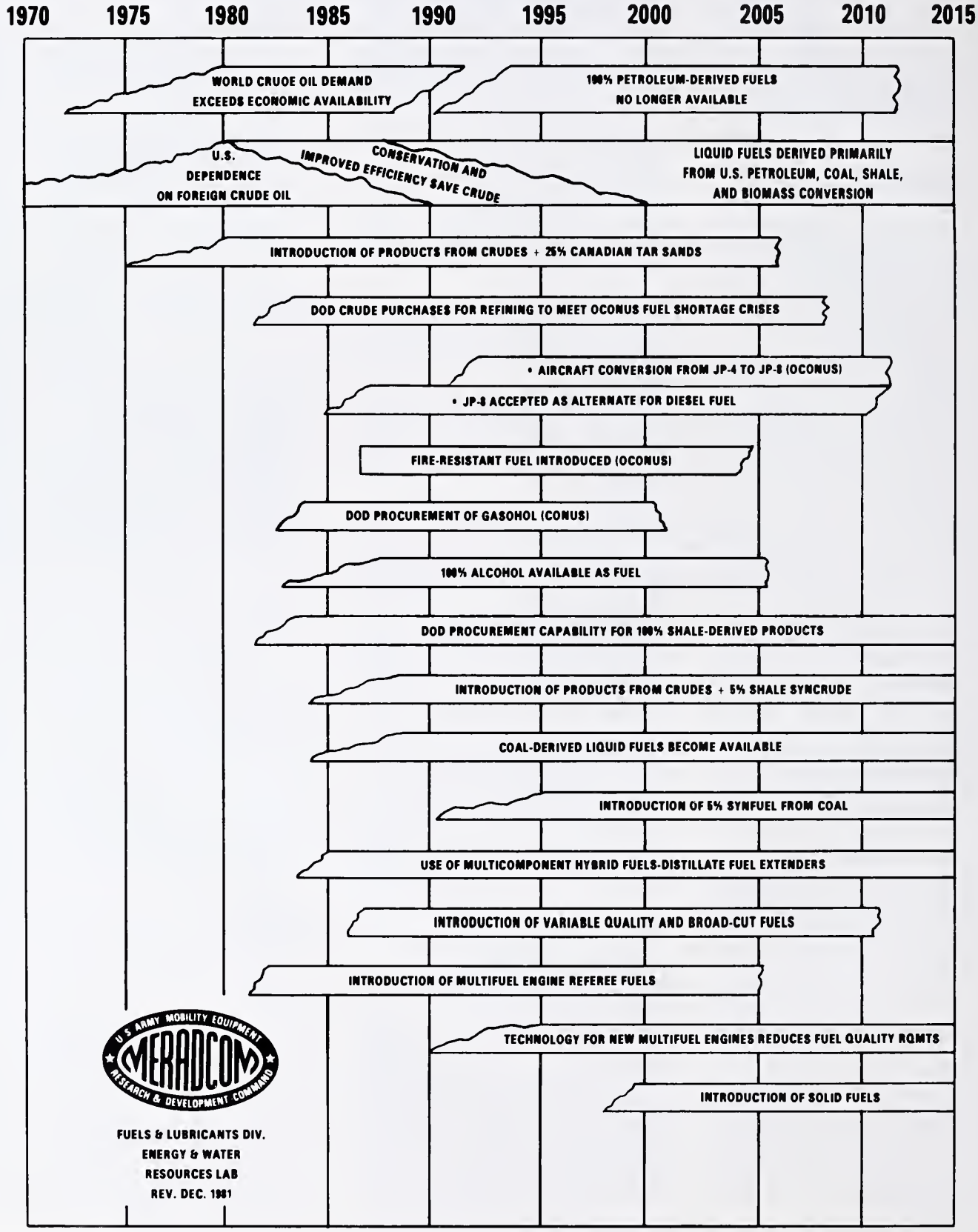
The Army Mobility Fuels Scenario is based on engineering judgement, current and projected technological development, and projected future fuel policies. The scenario is on a "time frame" basis through the year 2015, thus providing a baseline that can be easily modified by energy technology advancements, social and economic changes, and adjustments in governmental policies.

A graphic representation of the Army Mobility Fuels Scenario is shown on page 14. These efforts will, therefore, be dynamic and fall into four broad categories in support of the Airland Battle 2000 functional objectives of "Strategic Energy Self-Sufficiency." The first category is that of refinement and qualification of non-conventional fossil fuels. Concurrent with decreasing availability of conventional crude sources, new commercial processes for development of fuels from non-conventional fossil fuel sources will begin to evolve, decreasing U.S. dependence on foreign crude.

The Defense Logistics Agency (DLA) is now initiating procedures for procurement of crude oil. This represents a new policy for DLA as prior to this, only finished products were involved in procurement actions. The crude is being procured because of recent problems with small refiners in obtaining sufficient feedstock to meet DLA's contract bid procurement agreements. Small refiners have been historically the bulk supplier of finished products to the DOD community.

With the pending phase-in of JP-8 (NATO Code No. F-34) into OCONUS facilities in Europe, this fuel will be accepted as an alternate fuel for diesel applications. The acceptability of JP-8 will be based upon establishment of its cetane and lubricity requirements for procurement quantities following engine endurance testing. An initial sampling of commercial ASTM JET A-1 (essentially equivalent to JP-8) com-

ARMY MOBILITY FUELS SCENARIO



pleted in 1981 revealed these aviation fuels to meet all critical fuel properties for satisfactory diesel fuel performance.

In support of the recent DOD emphasis on developing a capability for using mobility fuels refined from variable crude sources, the U.S. Army will complete its accelerated program on utilization of shale-refined mobility fuels. As part of the recently-enacted loan guarantee agreements with the Synthetic Fuels Corp., shale-derived mobility fuels will be made available for DOD use in late FY 83 and FY 84.

Processes producing liquids from coal liquefaction will also emerge as sources for synthetic crude. These syncrudes however will require moderate upgrading.

Liquid fuels produced from coal liquefaction processes will approach five percent. This assumed liquefaction of coal will be used minimally for transportation fuels in the years 1980 to 1990 but maximized in producing burner fuels and gaseous fuels.

The second of the broad categories is refinement and qualification of biomass product fuels. Passage of recent legislation directed towards establishment of a new synthetic fuels industry will initially increase the overall capability for alcohol production. Methanol will become available by production from synthesis gas, coal, or destructive distillation from wood.

Ethanol will become available through fermentation of carbohydrates (i.e., sugar cane, corn, potatoes, etc.). The availability of these two alcohols will provide potential alternate and/or field emergency fuel sources for selected spark-ignition, ground turbine engine applications, and other continuous combustion equipment.

Synthetic fuels extenders/additives is the third category. In connection with Executive Order 12261, dated 5 January 1981 (which mandated use of gasohol in federal vehicles), gasohol has become an alternate substitute for those ground systems now consuming gasoline.

With the increasing sources of alcohol and other biomass materials, hybrid fuel blends will become available for not only spark-ignition engines, but also compression-ignition engines. These alcohol/biomass extenders for distillate/diesel fuel application will serve not only to extend the existing sources of available product, but also to improve the overall performance.

Fire-resistant fuel involving a new microemulsion technology will also become available for use in combat vehicle application. The current plan is that these fuels will only be used during hostile and/or combat situations.

Field fuel production is the final or fourth broad category. Research has been conducted to demonstrate the feasibility for direct utilization of crude oil as a field emergency fuel. This work has shown that 70-75 percent of the world crude reserves could be utilized as field emergency fuels in Army tactical engine systems.

The availability of large amounts of unrefined crude either due to refinery destruction (i.e., Iran and Iraq conflict) or diversion of tankers has become an increasing reality. To insure the direct suitability for using this crude, some preliminary pretreatment (i.e., removal of water, salt, sand, etc.) would be required.

Another approach has involved the development of portable field fuel production units which generate biomass-derived fuels and/or fuel extenders. The feedstock for these units would be vegetation, scrap wood/paper/cellulose, trees, grass, etc. The production units would generate methanol, ethanol, and/or other crude alcohol which can be utilized to power soldier support equipment and also augment some of the gasoline and distillate supplies.

In summary then, the framework for management of Army energy R&D efforts to accomplish the functional objective of strategic energy self-sufficiency in support of the Airland Battle 2000 Concept already exists in the form of the Army Energy R&D Plan. This plan is an evolutionary document which is updated annually to take advantage of technological advancements.

Successful execution of the plan through the judicious use of R&D resources to implement the facilities/installation energy programs and the mobility energy programs in a complementary fashion will require a cohesive effort at all levels of management within the Army's research, development, and acquisition system. The payoff to this challenge can be strategic energy self-sufficiency for the Army of the future.

CPT WILLIAM THOMAS BROADWATER, is the R&D coordinator for the Energy and Water Resources Laboratory at the Army Mobility Equipment R&D Command. He holds a BS degree in microbiology from Clemson University and a master's degree in environmental engineering from Virginia Tech.

MAURICE E. LEPERA is chief of the Fuels and Lubricants Division, Energy and Water Resources Laboratory, U.S. Army Mobility Equipment R&D Command. He received a BS degree in chemistry from the University of Delaware. Prior to his employment with the Department of the Army, he worked at Gulf Research and Development Co.

Famed WWI Figure . . .

New Air Defense Gun Named in Honor of SGT York

SGT Alvin C. York, the late World War I Medal of Honor winner who single handedly captured nearly 100 enemy soldiers in the Argonne Forest and who could reportedly shoot off the head of a turkey with a hog-faced rifle at 75 yards, would be "honored" to know the U.S. Army has named its new air defense gun system after him. So says Gracie Loretta York, 82, SGT York's widow whom the Army visited recently for the presentation of a scale-model gun system.

Slight, but in good health, Mrs. York still resides at the family homestead where the Wolf River winds through a valley between Jamestown and the Kentucky border.

"He'd be honored. He'd really appreciate it," she responded quickly when told the naming of the new weapon marked the first time the Army has named one after an enlisted man.

The Sergeant York Gun is the Army's key air defense modernization initiative for front-line units. It is a radar-directed, automatic gun to defend forward maneuver battalions, the new Abrams tank and the Bradley Fighting Vehicle against attack by fixed and rotary-wing aircraft.

It was developed under COL Charles C. Adsit, an ARRADCOM project manager. The Army recently let a contract to Ford Aerospace and Communications Corp., Newport Beach, CA, to produce Sergeant Yorks. The Army has three yearly options to buy 276 systems, and the value of the first increment is $317 million.

After World War I, SGT York received a tickertape parade in New York and became immortalized in a movie in which the late Gary Cooper played the title role, "Sergeant York."

York settled into a quiet life in this tiny hamlet surrounded by several hills which provided hunting ground for the sharpshooter. "There used to be contests for portions of beef," said Mr. Andrew Jackson York, a son who remembers his dad usually would end up winning the whole side of beef by shooting the head off a turkey more consistently than the other contestants.

"They would keep the turkey behind a wall, and you'd have to make sounds to get the animal to raise his head; then you'd have to shoot the head off in the split second it was raised," York explained.

He and his mother remember SGT York as a humble, generous man who never sought notoriety. "He never spoke of the war. He'd never tell anyone about it or brag about what he had done," said Mrs. York. "In fact, I didn't know about his achievements until I read about them in the *Saturday Evening Post.*"

"He never kept anything for himself," Andrew pointed out. "With the money he got from the movie, he gave $40,000 to the agriculture school and another $40,000 to the bible school. He was always signing notes for people . . ."

"There was one time when this man needed to borrow $150 to put his wife in the hospital," Mrs. York interrupted. "No bank would lend the money, but my husband did."

"He only had a fourth-grade education and he wanted all the youngsters around here to have a better chance," Mrs. York added. "So, he established the Agriculture Institute." It is a high school for about 700 mountain boys and girls. "It graduated 134 students this year," Mrs. York said proudly.

The York home is a 2-story colonial with simple columns in front. A flag waves over the front door, and another is perched in the living room next to a 16 by 20-inch photo of a middle-aged SGT York smiling and tipping his Stetson.

"He was proud of his service in the Army and was very happy to travel to Fort Knox and Campbell and several camps in World War II. He talked to soldiers about patriotism, and he gave them tips on shooting."

Bedridden 10 years, York died in 1964, three months shy of his 77th birthday. He was buried in the family plot on a rise across the river and a little more than "hollerin' distance" from home.

The woman who was barely 17 when he proposed to her, just before he left for World War I, and who made him wait for marriage until after the War ("I told him I was too young to get married"), says she still misses him and is glad the Army has not forgotten him.

MERADCOM Revising Diesel Fuel Specs

New specifications for cold weather diesel fuel are being developed by the Fuels and Lubricants Division of the U.S. Army Mobility Equipment R&D Command, Fort Belvoir, VA.

Diesel fuel contains quantities of paraffinic hydrocarbons. At low temperatures this substance will form wax-like crystals that can plug fuel filters and restrict fuel flow. This causes hard starting and stalling in cold weather. The laboratory became involved when a number of the Army's tanks and armored personnel carriers experienced these problems in Europe and the United States.

The most important factor in cold weather operations is the cloud point of the fuel. This is the temperature at which a cloud or haze of wax crystals appears in the fuel. A vehicle can operate as long as the cloud point of its fuel is at or below the ambient temperature.

Diesel fuel is selected based on the 10th percentile minimum temperature, the lowest temperature to occur 90 percent of the time. A survey of 30 locations in Germany found that the 10th percentile minimum for that area was −10 °C or fifth percentile minimum was −17 °C. The average cloud point of F-54 diesel fuel supplied to the area was −20 °C (−17 °C to −24 °C). This meant that vehicles were at times operating with fuel at its cloud point.

In order to solve this problem, the laboratory recommended blending kerosene-based JP-5 aviation fuel with the diesel fuel in order to lower its cloud point and enable the fuel to be used at lower temperatures. Other kerosene-based fuels and solvents could be substituted if JP-5 was not available.

More long-range solutions are currently being considered. The Project Manager for the M2 Abrams tank initiated a program to develop a cold weather kit for the tank which would use ribbon heaters, flat bonds containing heating elements that can be wrapped around fuel lines and filter surfaces to warm the fuel.

Another factor contributing to cold weather problems in contamination of the fuel with water which causes fuel lines and filters to freeze. New requirements will be established for using filter separators to remove water when fueling vehicles.

The progress of the work to lower the cloud point requirement of diesel fuel will be discussed at a meeting of the NATO Fuels and Lubricants Working Party later this year.

Army Tests Gunship Wire Strike Protection System

Developmental and verification tests of an AH-1S Cobra helicopter Wire Strike Protection System were recently conducted by the Army. The system is a wire deflector and cutter system that will significantly reduce the incidence of helicopter accidents and crew fatalities resulting from in-flight strikes of horizontally strung mechanical and communications wire and cables.

The test vehicle was an AH-1S Cobra helicopter equipped with a 20mm cannon and TOW missile firing system. The U.S. Army Aviation R&D Command's (AVRADCOM) Applied Technology Laboratory (ATL), Fort Eustis, VA, installed and successfully tested the AH-1S WSPS. These tests were conducted at the Impact Dynamics Research Facility, NASA-Langley Research Center, Hampton, VA. ATL is one of four laboratories of the U.S. Army Research and Technology Laboratories (AVRADCOM).

The AH-1S's test configuration consisted of four major components: an upper cutter mounted on the helicopter centerline above the pilot's station; a lower cutter mounted on the aircraft centerline near the forward edge of the landing gear; a deflector mounted on the telescopic sight unit located at the nose of the helicopter; and, a small chin cutter mounted above the 20mm cannon. The sight unit deflector guides the cable/wire to the chin cutter.

The gunship was raised by swing cables, pulled back to an appropriate height, and then pendulum swung at speeds of 15 and 40 knots to cut a 3/8-inch steel, 7-strand cable which was strung about 20 feet above the ground. Each of the four major protective system components were successfully tested.

"During the WSPS installation we discovered that some components could be eliminated and that the installation procedures could be simplified, resulting in reduced cost and weight," explained Mr. LeRoy T. Burrows, project engineer. In addition, results revealed that a small cutter should be added to prevent cable snag on the air data boom for the negative yaw wire impact case.

As a result of the successful test program, the Army plans to pursue the production and worldwide fleet implementation of the wire strike protected AH-1S Cobra. The gunship was the third helicopter so protected to be tested by ATL. The OH-58 Kiowa was tested in 1979 and the UH-1H Iroquois in 1981-82. The long range plan is to retrofit all U.S. Army helicopters with wire strike protection.

The protected AH-1S was designed for AVRADCOM by Bristol Aerospace Ltd and Bell Helicopter Textron.

ATTENTION Authors

Do you have an article you would like to submit for possible publication in the *Army RDA Magazine?* If so, we would like to hear from you. Consideration will be given to all articles, based on importance of the subject, factual content, timeliness, and relevance to our magazine. The following are general guidelines for submissions:

- *Length.* Articles should be about 2,500 to 3,000 words. Shorter or longer articles are acceptable, depending on what is required to adequately tell the story.
- *Photos.* Include any photographs or illustrations which complement the article. Black or white or color are acceptable. We cannot promise to use all photos or illustrations and they are normally not returned unless requested.
- *Biographical Sketch.* Include a short biographical sketch and photo of the author/s.
- *Clearance.* Article must be cleared by author's security/OPSEC Office prior to submission.

Articles should be addressed to: HQ DARCOM, ATTN: DRCDE-OOM, 5001 Eisenhower Avenue, Alexandria, VA 22333. Telephone: Autovon. 284-8977, Commercial 202-274-8978.

Contracts Total $15 Million for 54 Generators

Contracts totaling nearly $15 million have been awarded by the U.S. Army Mobility Equipment R&D Command (MERADCOM), for 54 new 750 kW generators scheduled to be delivered next year. The buy is part of a program to upgrade military electrical power systems, being conducted jointly with The Facilities Engineering Support Agency (FESA), also at Belvoir, and the U.S. Navy.

Twelve generators will go to FESA as part of the Army's Productivity Enhancing Capital Investment Program. FESA plans to use them in conjunction with centralized control vans that will enable four generator sets to be operated from one location. This will reportedly simplify operations and reduce the number of personnel required.

MERADCOM is responsible for the design, fabrication, and testing of these vans. This 2-year effort is expected to cost $1.9 million and should save 55 man-years annually. The command will buy the vans from the Navy and install necessary equipment to permit operation of these existing generator sets.

MERADCOM is also designing field modification kits which will be used with generators already in the field. This will make the entire inventory of generators compatible with the vans.

The remaining 42 generators will go to the Naval Facilities Engineering Command, Alexandria, VA, and the Navy Environmental and Engineering Support Activity, Fort Hueneme, CA.

The 750 kW engine generator, which is produced by Fermont Division of Dynamics Corp. of America, weighs 40,000 pounds, compared to 90,000 pounds for the generator it will replace. The unit is skid mounted, air transportable and more cost and fuel efficient than the generators presently in use.

MERADCOM Orders Additional Tanker Mooring Systems

The U.S. Army Mobility Equipment R&D Command, Fort Belvoir, VA, has exercised $ 3.1 million option on a contract with Ocean Search, Inc., for the purchase of two additional Military Tanker Mooring Systems.

The Tanker Mooring System, which is air transportable and capable of handling ships as large as 25,000 deadweight tons is designed to unload bulk liquid fuel over undeveloped beaches, or where facilities are unusable because of battle damage or natural disaster.

Each leg of the mooring system is a packaged system incorporating explosive embedment anchor. The system also includes buoys, boat launching and recovery equipment, a motor surf boat, underwater survey equipment and tanker unloading equipment.

Mooring sites can be located up to 5,000 feet from shore. Ships can discharge their bulk through submarine pipelines to onshore storage facilities. This new system will give the Army the capability to establish a marine terminal rapidly in an unimproved area to assure adequate fuel supplies for troop deployments and sustaining operations.

BRL Improves Technology for Projectile Performance

By Dr. Bruce P. Burns & Richard D. Kirkendall

Among all the armament areas the Army has examined in the past decade, few have improved as dramatically as tank ammunition technology. Specifically, the Army Ballistic Research Laboratory has been engaged in a 9-year effort to develop technology for an armor defeating, kinetic energy projectile with unsurpassed performance.

Initial concepts for contemporary armor-piercing, spin-stabilized, saboted projectiles are credited to Germany and the United Kingdom, while those for finned, rather short, saboted kinetic energy projectiles originated at the U.S. Army's Picatinny Arsenal.

BRL conducted the initial study that provided fundamental parameters to achieve major performance improvements in finned projectiles. Features such as very slender-rod penetrators, higher gun pressures, and monoblock high-density materials for the rod penetrators were envisioned. These studies emphasized the need to develop a firm engineering base for the design of low-mass sabot configurations.

Development efforts began in 1973 when BRL was funded to explore advanced fin-stabilized, high-density, long-rod penetrators launched from high pressure, medium-caliber, antiarmor automatic cannon.

A 60mm bore, long-barreled gun was used as a test vehicle. At that time, the Army was experiencing difficulties with sabots, the thrust-transmitting lightweight carriers that are discarded when a subcaliber projectile or missile is fired.

Simultaneously, a companion technology program concentrated on in-depth studies of several aspects of sabot function.

The BRL portion of the medium-caliber automatic cannon program was initiated to provide specific interior, exterior, and terminal ballistics technology for improving firepower that could defeat medium size enemy tanks with weapons of significantly smaller caliber than existing tank guns.

Comparable armor penetration was achieved with 50 percent less propellant. Since medium-caliber, automatic, cannon-type weapons and tank guns, in general, are very high performance weapons, the challenge was to achieve launch with minimum parasitic sabot weight. Upon discard, the energy transferred to the sabot during acceleration is lost and is not available for armor penetration.

Advances in sabot technology were combined with efforts in penetration and flight mechanics, and have impacted three international firing trials. Projectile candidate designs were furnished by BRL in the last two and were successful. These efforts resulted in a high-performance prototype projectile and the current high-technology tank round.

The prototype round is presently under development at the Large Caliber Weapons Systems Laboratory, Dover, NJ, while the current high technology program is a joint effort between that laboratory and the BRL.

The key for success was the application of advanced structural analysis. High-density penetrator substances are surprisingly poor structural materials. For example, the strength to density ratio is about 20 to 25 percent of that found in an advanced steel or a high strength aluminum, magnesium, or titanium alloy.

In the very high acceleration environment encountered by a low-mass projectile in a high-pressure gun, the design to provide adequate support of the high-density material requires rigorous analysis. The event is unforgiving if an error is made and normally results in projectile disintegration while in the gun. Finite element techniques form the core of the design process.

DR. BRUCE P. BURNS, (left), a mechanical engineer, is deputy chief of the Mechanics and Structures Branch in the Interior Ballistics Division of the Ballistic Research Laboratory. He has a BS degree and an MS degree in mechanical engineering, and a doctorate in applied mechanics from Drexel University. He was awarded Army R&D Achievement Awards in 1976 and in 1980 for efforts in the Army's MC-AAAC program and in projectile joint analysis.

MR. RICHARD D. KIRKENDALL, is a mechanical engineer in BRL's Mechanics and Structures Branch. His major technical efforts have been in the development of instrumentation and the dynamics of guns, gun mounts, and projectiles. He received an Army R&D Achievement Award in 1979 for contributions to 105mm and 120mm projectiles.

The key to achieve structural integrity rests with the contour of the sabot. Shapes and interface details are carefully designed to transmit the axial thrust in a nearly uniform fashion along a considerable length of the high-density penetrator. This results in a "ramp-like" appearance of the sabot and in very-low-mass configurations. Projectile in-bore sealing is also enhanced.

One difficulty encountered with the long-rod projectiles was accuracy. Initial attempts to design in-bore dynamically stable projectile configurations did achieve considerable success. However, that part of the technology wasn't quite mature enough for the incorporation into the recent tank projectiles.

Specific modifications to the projectiles were implemented to satisfy dispersion requirements. Efforts are underway to provide additional understanding of the phenomenology associated with configurations that are stable while accelerating in a gun.

Current technology development efforts are focused on the evaluation of low-cost sabots for automatic cannon applications, and prototypes have been cooperatively designed with the Fire Control and Small Caliber Weapon Systems Laboratory for the 25mm Chain Gun.

New composite material applications which may reduce sabot weight are also being pursued. An extension of the existing structural analysis capability is required in order to provide detailed designs using these materials.

In addition, improved computer graphics will allow results of these kinds of computations which can be quickly digested. These continuing efforts to generate additional sabot technology are expected to provide significant improvements in performance and reduce development time and costs.

Capsules . . .

Mine Clearing Roller Adapter Displayed

The U.S. Army Mobility Equipment Research and Development Command demonstrated its mine clearing roller adapter on the Abrams tank recently at Aberdeen Proving Ground, MD for senior military and civilian personnel.

The adapter is under development to permit the roller, designated for the M60 tank, to be mounted on the new Abrams. The demonstration, supported by Army Test and Evaluation Command personnel, provided observations on adapter performance, roller behavior on the more powerful new tank, and tank reaction to additional front-mounted weight.

Film-recorded trial runs compared two Abrams tanks, one with roller and one without, under conditions ranging from flat, hard-surfaced roads to cross-country terrain, including mud. They were geared to determine adapter and roller performance relative to top speed, acceleration, and maneuverability.

Extensive testing of the roller-adapter is being scheduled for this fall.

Army Unveils New Hydraulic Test Facility

The U.S. Army Mobility Equipment R&D Command, Fort Belvoir, VA, has developed a hydraulic test facility in an effort to provide base line data for the standardization of test methods and procedures in the qualification of hydraulic pumps and components used in military applications.

The primary component of the test stand is a 200-horsepower dynamometer with variable speed to 4,500 revolutions per minute. A hydraulic control system allows adjustment to the line pressures and flow rates, fluid temperature, and time controlled cyclic load. The cyclic load capability, approximately one-half second on, one-half second off as a minimum, provides an impulse type test to determine component durability during endurance and reliability testing.

During testing, the system is continuously monitored by a computerized data acquisition system capable of providing on-line efficiency readouts and all performance characteristics. The computer also monitors critical parameters for tolerance deviations during tests and aborts the test in the event any are exceeded.

The computer system can provide hard copy graphic presentations of system performance. An analog data acquisition system is also available to provide time-variance recordings of the system parameters.

'Copter Refueling System Cuts Set-Up Time

Two Army aviation companies stationed in the Republic of Korea have reportedly developed helicopter refueling systems, using the Army's Forward Area Refueling Equipment, that have cut normal set-up time by more than 90 percent. The systems were recently demonstrated for Dr. Jay R. Sculley, Assistant Secretary of the Army for Research, Development and Acquisition.

One of the quick reaction refueling systems was developed to refuel UH-1 Huey helicopters by the 52d Aviation Battalion's 271st Aviation Company, Camp Humphreys. Both are assigned to the 17th Aviation Group (Combat).

Using elements of the Forward Area Refueling Equipment, which are normally deployed to the field separately and then set up, the quick reaction systems are set up and palletized before deployment, cutting field set-up from the normal 45 minutes to less than three minutes.

The systems, operated by a crew of four POL specialists contain a fuel source, gas-driven pump, a filter-separator, hoses, fittings, and fire extinguishers.

Using a 600-gallon fuel tank, the Huey system can refuel three UH-1s in about six minutes, adding two hours of flying time for each aircraft. The Chinook system, with two 500-gallon collapsible drums, refuels both tanks of a CH-47 in about 10 minutes, adding three hours flying time.

Both systems are deployed to forward areas by sling-loading under a Chinook helicopter.

The palletized configuration was developed in Korea to combat the constraints on aviation caused by the lack of refueling points and the inaccessability of many remote field locations in the Republic. "In other areas of the world, aviation companies deploy fuel and field operations in tank trucks, but the lack of roads here meant we had to come up with another way to deploy fuel," said MGST James Neal, NCOIC of Operations for the 52th Aviation Battalion (CBT).

Fort Belvoir Will Host Noise Symposium

An initial call for papers proposed for presentation at an Acoustic Noise and Thermal Infra-Red Symposium, 3-4 November 1982 at Fort Belvoir, VA, has been issued.

The symposium, which is being sponsored by the DOD Project Manager for Mobile Electric Power and the U.S. Army Mobility Equipment R&D Command, will emphasize generator sets and related equipment. Specific topics will include vulnerability and detection of generator sets, acoustic noise and thermal IR signatures, requirements, and signature suppression techniques.

Additional symposium information may be obtained from: DOD Project Manager-Mobile Electric Power, ATTN: DRCPM-MEP-T, 7500 Backlick Road, Building 2089, Springfield, VA or Mr. P. Noring, AUTOVON 354-2125/2057.

$5 Million Contract Orders Waste Site Cleanup

A $5.2 million contract has been awarded on behalf of the U.S. Army's Toxic and Hazardous Materials Agency (USATHAMA) for the cleanup of two hazardous waste sites at the Anniston Army Depot, AL. Roy F. Weston, Inc., Decatur, GA, was awarded the contract by the Huntsville Division of the U.S. Army Corps of Engineers.

Mr. Robert J. York, USATHAMA project officer, indicated that the cleanup operations will be conducted in three phases, and that the contractor will be responsible for obtaining any necessary permits and will develop a closure program for each of the waste sites. It is estimated that 37,000 cubic yards of toxic materials will be relocated.

Correction

Due to a typographical error, the last name of MERADCOM Technical Director Mr. Thomas W. Lovelace was spelled incorrectly in our July-August issue (centerspread). Our apology for any resulting inconvenience to Mr. Lovelace.

Personnel Actions . . .

Potts Becomes MICOM Deputy for R&D

BG William E. Potts

BG William E. Potts, former deputy commander for Readiness, U.S. Army Missile Command (MICOM), Redstone Arsenal, AL, has assumed new duties as MICOM's deputy commander for R&D.

Graduated with a BS degree in business administration from Vanderbilt University, BG Potts also holds an MS degree in public administration from Middle Tennessee State University, and has completed requirements of the Industrial College of the Armed Forces, Army Command and General Staff College, Ordnance School of Advanced Course, and Transportation School Basic Course.

A veteran with more than 23 years of service, he served from 1979-81 as executive to the deputy chief of staff for Logistics, DA, following a tour as commander, Division Support Command, 82d Airborne Division, Fort Bragg, NC.

Other assignments have included logistics staff officer, Materiel Readiness Directorate, Office, Deputy Chief of Staff for Logistics, DA, and chief, Personnel Assignment Section, later chief, Ordnance Branch, Officer Personnel Management Directorate, U.S. Army Military Personnel Center, Alexandria, VA.

Listed among his honors are the Meritorious Service Medal with Oak Leaf Cluster (OLC), Joint Service Commendation Medal with three OLC and the Master Parachutist Badge.

Rodgers Chosen as CEEI Agency Commander

BG T.D. Rodgers

BG T.D. Rodgers, former deputy director for Systems Development, Integration and Engineering, Office, Deputy Chief of Staff for Operations and Plans, has assumed new duties as commander, U.S. Army Communications-Electronics Engineering Installation Agency, and PM, Defense Communications Systems (Army).

Graduated with a BS degree in electrical engineering from Tennessee Technological University and an MA degree in public administration from the University of Northern Colorado, BG Rodgers also completed Army Command and General Staff College and the Army War College.

During 1977-81, he served first as deputy commander and then as commander of the 7th Signal Brigade, U.S. Army Europe, Germany. Prior to these tours, he was chief, Plans Branch, Plans and Operations Division, Office, Chief of Legislative Liaison, Department of the Army.

Other key assignments have included commander, 51st Signal Battalion, I Corps, ROK/U.S. Group, Korea; and staff member, Satellite Branch, Communications Systems Directorate, J-6, Organization of the Joint Chiefs of Staff.

BG Rodgers is a recipient of the Legion of Merit, Bronze Star Medal, Meritorious Service Medal (three awards), and the Army Commendation Medal.

Price Commands Aeromedical Laboratory

COL Dudley R. Price

COL Dudley R. Price has assumed command of the U.S. Army Aeromedical Laboratory (USAARL), Fort Rucker, AL. COL Stanley C. Knapp, commander of USAARL since July 1977, is the new command surgeon of the Rapid Deployment Joint Task Force, MacDill Air Force Base, FL.

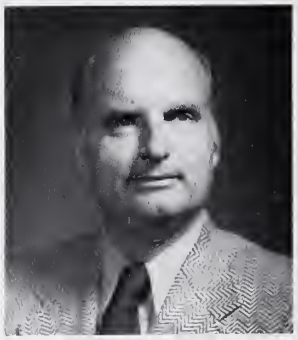
COL Price received his BA degree from Virginia Military Institute, his MD from Duke University School of Medicine, and served his internship at Walter Reed Army Medical Center. He has completed the Army Medical Department Officer's Advanced Course, residency in aerospace medicine at the Naval Aerospace Medical Institute, received a master of public health degree from the University of Southern California, Berkeley, and did his residency training in psychiatry at Walter Reed.

Additionally, he has served as flight surgeon for the U.S. Army Medical Command, Japan; surgeon in the 12th Combat Aviation Group, Vietnam; chief of Professional Services, Tuttle Army Hospital, Hunter Army Airfield, GA.; chief of Psychiatry, DeWitt Army Hospital, Fort Belvoir, VA; and chief of Alcohol-Drug Abuse Service, Walter Reed. In June 1980, he was assigned as chief of the Department of Community Health and chief of Professional Services—Deputy Commander of the U.S. Army Aeromedical Center at Fort Rucker.

COL Price is a senior flight surgeon and a Diplomate of the American Board of Preventive medicine in Aerospace Medicine. He is also a fellow of the American College of Preventive Medicine.

His decorations and awards include the Bronze Star Medal with Oak Leaf Cluster, the Meritorious Service Medal, the Army Commendation Medal, and the Air Medal with OLC.

Immen Heads AVRADCOM Structures Division



Mr. Frederick H. Immen

Mr. Frederick H. Immen, former chief of the Advanced Systems Research Office, Army Research and Technology Laboratories (AVRADCOM), Moffett Field, CA, has assumed new duties as chief of AVRADCOM's Structures Division, Directorate of Development and Qualification, St. Louis, MO. Mr. Andrew W. Kerr, an aerospace engineer with the Research and Technology Laboratories will succeed Immen.

Immen's new assignment will include responsibilities for structural flight worthiness for all new Army aircraft. He will also perform half of the duties formerly performed by Dr. Daniel Schrage, former chief of the Structures and Aeromechanics Division.

Prior to joining the Research and Technology Labs in 1971, Immen served with the Boeing Vertol Co. in several assignments, including chief of Stress and chief of R&D Structures. A former navy helicopter pilot and commanding officer of a helicopter antisubmarine squadron, he holds a bachelor's degree in mechanical engineering from Cornell University and has authored numerous technical articles.

Whalin Selected as CERC Technical Director

Dr. Robert W. Whalin

Dr. Robert W. Whalin has been appointed technical director of the U.S. Army Corps of Engineers' Coastal Engineering Research Center (CERC). He is currently chief of the Wave Dynamics Division, Hydraulics Laboratory, Waterways Experiment Station, Vicksburg, MS.

CERC, which is presently located at the U.S. Army Corps of Engineers' Kingman complex near Fort Belvoir, VA, will be relocated to and consolidated with WES in the near future. Both the Hydraulics Lab and CERC conduct research on coastal engineering.

Whalin's academic credentials include a BS degree in physics from the University of Kentucky, an MS degree in physics from the University of Illinois, and a PhD in physical oceanography from Texas A&M. Prior to joining the Corps of Engineers, he was with Tetra Tech Inc., Pasadena, CA.

In June 1981, he was selected for the Army's Senior Executive Service Candidate Development Program. He becomes a member of the SES upon his appointment with CERC. A registered professional engineer, he is listed in several *Who's Who* publications, and is a member of several professional organizations.

Richardson Chosen as CSL Deputy Director

Dr. Bill Richardson, a research biologist and physical science administrator, has been named to succeed Dr. B.L. Harris as deputy director of the Army Armament R&D Command's Chemical Systems Laboratory.

Recently selected as a member of the Federal Senior Executive Service, Richardson has directed exploratory research and advanced technology programs for the U.S. Air Force Aerospace Medical Division, Brooks Air Force Base, San Antonio, TX, since 1967.

Prior to his appointment to CSL, he managed the Air Force continuous long-term project in advanced biomedical studies related to aircrew and ground personnel. He also organized the program office that initiated the first U.S. Air Force exploratory development program on chemical defense.

His academic credentials include bachelor's, master's and PhD degrees from Texas A&M University. Additionally, he is a graduate of the Army War College and is a "fellow" of the American Institute of Chemists and the Aerospace Medical Association.

He is also a member of the American Institute of Biological Sciences, the American Management Association, New York Academy of Science and the American Defense Preparedness Association.

Whittaker Assumes Duties as CSL Commander

BG Howard C. Whittaker, a veteran of more than 26 years of active military service and deputy commander of the U.S. Army Armament R&D Command since August 1980, has assumed additional duties as commander of the U.S. Army Chemical Systems Laboratory.

A 1955 graduate of the U.S. Military Academy, BG Whittaker received a master's degree in education from Boston University and has completed requirements of the Army Command and General Staff College and the Army War College.

During 1977-80, he served as Hawk project manager at the U.S. Army Missile Command, following tours as PM, Chaparral/Forward Area Alerting Radar, and PM, Kuwait Missile System, all at Redstone Arsenal, AL.

Other key assignments have included special assistant to Dragon PM, and logistics staff officer, War Plans Division, Plans, Doctrine and Systems Directorate, Office, Deputy Chief of Staff for Logistics, Department of the Army.

BG Whittaker's military honors include the Legion of Merit, Meritorious Service Medal, and the Joint Service Commendation Medal with Oak Leaf Cluster.

Conferences & Symposia . . .

380 Summaries Submitted . . .

13th ASC Features 96 Technical Papers

PAUL A. SIPLE AWARD is received by Thomas R. AuCoin (left) for an ERADCOM-paper, authored by AuCoin, Roger J. Malik, Raymond L. Ross and Robert O. Savage. ASA (RDA) Dr. J.R. Sculley presented the award at the U.S. Army Science Conference, U.S. Military Academy.

Ninety-six technical papers, chosen from more than 380 narrative summaries submitted from Army major commands, activities, and agencies, were presented during the 13th U.S. Army Science Conference at the U.S. Military Academy, West Point, NY.

Sponsored by the Office of the Deputy Chief of Staff for Research, Development and Acquisition, HQ DA, the meeting drew more than 275 scientists and administrators from the Army R&D community.

The 96 papers selected for presentation, along with 34 supplemental papers, were reviewed by the Army Science Board which selected 18 additional papers for special recognition.

The coveted Paul A. Siple medallion, bronze medallions for scientific achievement, and certificates signed by Assistant Secretary of the Army for RDA Dr. J.R. Sculley and Army Deputy Chief of Staff for RDA LTG James H. Merryman, were awarded. Dr. Sculley presented the awards.

The Paul A. Siple silver medallion and a $1,500 cash award were presented to Messrs. Roger J. Malik, Thomas R. AuCoin, Raymond L. Ross, and Robert O. Savage of the Electronics Technology and Devices Laboratory, Fort Monmouth, NJ, for their paper on *The Planar Doped Barrier: A New Class of Electronic Devices.*

A bronze medallion, certificate for outstanding achievement and a $500 cash award were earned by: Messrs. Charles J. Nietubicz and Walter B. Sturek, and Karen R. Heavey, Ballistic Research Laboratory, for *Computations of Projectile Magnus Effect at Transonic Veolcities;* Messrs. Frank DeVenuto and Angelo I. Zegna, Letterman Army Institute of Research, for *The Development and Evaluation of Hemoglobin Solution as a Blood Substitute;* Mr. Erik A. Hen-

chal, J.M. McCown, M.K. Gentry, and W.E. Brandt, Walter Reed Army Institute of Research, for *Rapid Identification of Dengue Virus Serotypes Using Monoclonal Antibodies in an Indirect Immunofluorescence Test;* and Messrs. Everett E. Gilbert, Gilbert P. Sollott, Jack Alster, Oscar Sandus, and Norman Slagg, Armament Research and Development Command, for *Toward More Powerful Explosives—Polynitro Polyhedranes.*

Also receiving bronze medallion and a $200 cash award were: Messrs. Sol Gilman, William Wade, and Michael Binder, Electronics Technology and Devices Laboratory, for *High Energy Sulfuryl Chloride Batteries*; Messrs. John Borowick and William Bayha, Combat Surveillance and Target Acquisition Lab and Messrs. Richard Stern and Richard W. Babbitt, Electronics Technology and Devices Laboratory, for *Dielectric Waveguide Antenna*; Mr. Gene J. Bingham, Structures Laboratory, for *The Aerodynamic Influence of Rotor Blade Taper, Twist, Airfoils and Solidity on Hover and Forward Flight Performance*; and Mr. John C. Twartz, Akira Shirai, G. Selvaraju, J. Peter Saunders, Mr. David L. Huxsoll, and Mr. Michael G. Groves, Army Medical Research Unit, Kuala Lumpur, Malaysia, for *Doxycycline Prophylaxis of Scrub Typhus.*

Certificates of outstanding achievement were awarded to: Messrs. William P. Ashman, James H. Lewis, and Edward J. Poziomek, Chemical Systems Laboratory for *A Decision Tree for Chemical Detection Application*; Mr. Glenn Randers-Pehrson, large Caliber Weapon Systems Laboratory, for *Non-axisymmetric Anti-Armor Warheads*; Messrs. Howard A. Jenkinson and John M. Zavada, Fire Control and Small Caliber Weapon Systems Laboratory, for *CO2 Laser Waveguiding in GaAs MBE Layers*; R.S. Rohde, R.G. Buser, M.C. Norton, R.E. Dixon, N.T. Nomiyama, and S. Chandra, Night Vision and Elector-Optics Laboratory, for *Laser Technology for Identification on the Modern Battlefield*; Messrs. Richard L. Goodyear and John J. Bertin, U.S. Military Academy, for *Multiple Launch Rocket Systems (MLRS) Fuze*; Mr. Morris Campi, Harry Diamond Laboratories, for *Design of Microstrip Linear Arrary Antennas by Computer*; Mr. William C. Kelly, Missile Command, for *Missile Control in the Presence of Disturbances—Recent Developments*; and Mr. James W. Voorhees, Kristine M. Marchionda and Valerie L. Atchison, Aeromechanics Laboratory, for *Speech Command Auditory Display System.*

The major portion of the second day of the conference was devoted to long-range planning. This general session was keynoted with an address by LTG James H. Merryman on "Technology for the Army of the '90s". Representatives from major commands also presented their overview of long-range planning.

An overview of West Point and its place in the military, presented by Superintendent LTG Williard W. Scott, Jr., was also well received. Under Secretary of the Army James R. Ambrose closed the long-range planning session with a wrap-up, giving the Secretariat's point of view in the planning process.

Dr. Robert E. Weigle, director of the Army Research Office, served as master-of-ceremonies at the banquet and awards ceremony.

Navy Will Host Nondestructive Test Conference

The 31st Defense Conference on Nondestructive Testing, hosted by the Supervisor of Shipbuilding Conversion and Repair, U.S. Naval Support Activity, Seattle, WA, will be held from 2-4 November 1982. Attendance is restricted to military and civilian employees of the U.S. Department of Defense and other U.S. Government agencies.

Established in 1951, the conference is designed primarily to provide a forum for DOD agencies to share information and use the assembled expertise to identify potential solutions to nondestructive testing problems.

One day prior to this year's meeting (1 November), there will be a management seminar for DOD managerial personnel. Topics will include cost/benefit considerations, contributions of NDT to materiel readiness, legal aspects, and resource utilization.

The Defense Conference on Nondestructive Testing is directed by a steering committee consisting of a chairman, a permanent secretary-treasurer, a host representative, and two members each from the Army, Navy, and the Air Force.

Additional conference information may be obtained from Mr. Douglas E. Arnold, SUPSHIP, U.S. Naval Support Activity, Seattle, WA 98115 or Autovon 941-3971 or 3972 or commercial (206) 527-3971/2.

Career Programs . . .

33rd Annual ISEF . . .
Army Selects 24 Winners for Top Awards

ISEF Winners (from left) Tracy Lee Peters, London International Youth Science Fortnight; Catania M. Gregory and Dagmar Taborsky, Operation Cherry Blossom (flanking MG Gorman C. Smith, USAR, U.S. Army Training and Doctrine Command, who presented the awards).

From more than 500 finalists at the 33rd International Science and Engineering Fair held in Houston, TX, 24 top student scientists were chosen to receive Department of the Army Superior and Meritorious Achievement Awards.

Winners of "Operation Cherry Blossom" and "London International Youth Science Fortnight", chosen from among Army Superior Award winners, also received $100 from the Association of the United States Army.

Sponsored by the Science Service, a non-profit institution dedicated to public understanding of science, the annual ISEF culminates competition among high school students in more than 280 science fairs held in 44 of the 50 states, and in Canada, Israel, Japan, Puerto Rico, the Republics of China and Korea, Sweden, and the United Kingdom.

Exhibits of student research projects encompassed the areas of behavioral and social sciences, biochemistry, botany, environmental sciences, medicine and health, microbiology, zoology, chemistry, earth and space sciences, engineering, mathematics and computers, and physics.

The Army panel of judges, chaired by Dr. Gordon L. Bushey, HQ U.S. Army Materiel Development and Readiness Command, consisted of laboratory and reserve officers knowledgeable in each of the above categories.

Operation Cherry Blossom. The Army presented two Operation Cherry Blossom awards consisting of an expense-paid

trip to Tokyo, Japan, to attend the 26th Annual Japan Student Science Awards program in January 1983.

Catania Maria Gregory, a 17 year-old senior at Watkins Overton H.S., Memphis, TN, received the award for her project "The Role of Cell Surface Oligosaccharides in Macrophage-Tumor Interactions." Gregory, a three-time finalist in the ISEF since 1980, also received a first award in biochemistry for her exhibit.

Dagmar Renata Taborsky, an 18 year-old senior at Palmetto H.S., Palmetto, FL, was selected for her project on "Waste Water Bioclarification." Taborsky's exhibit won five other federal and industrial awards in addition to the Army's OCB and Superior Achievement Awards. She has been a finalist at one previous ISEF.

Army alternate for the Japan trip is John Patrick Hegarty, an 18 year-old senior at Bishop McDevitt H.S., Harrisburg, PA. His project, "Establishing A Cell Transformation Assay for Herpes Simplex Virus DNA," won a total of five federal and industrial awards.

The Army has been participating in Operation Cherry Blossom since 1963 when it was initiated in cooperation with the Japanese newspaper *Yomiuri Shimbun.*

London International Youth Science Fortnight. Tracy Lee Peters, a 17 year-old senior at Ygnacio Valley H.S., Concord, CA, was selected to receive an expense-paid trip to London for his exhibit, "Penetration and Diffusion of Supersonic Fluid." Mr. Peters, a four-time ISEF finalist since 1979, won a total of nine federal and industrial awards at the 1982 ISEF, including an all-expense paid visit to Stockholm, Sweden, in December, to attend the Nobel Prize Ceremonies. This award was presented by General Motors.

Army alternate for the London trip is Craig Charles Dochniak, an 18 year-old senior at F.W. Springstead H.S., Spring Hill, FL. His exhibit, "Polyethylene Glycol Compared to Polyvinyl Acetate in Waterlogged Wood Preservation", also won Second Award in the chemistry awards category.

Winners and alternates of both the Operation Cherry Blossom and London International Youth Science Fortnight awards received congratulatory letters from the Secretary of the Army.

MG Gorman C. Smith, USAR, U.S. Army Training and Doctrine Command, Fort Monroe, VA, presented the awards for the Department of the Army.

Army Superior Awards, consisting of a Certificate of Achievement, a gold medallion, and a one-week, expense-paid orientation visit to an Army R&D facility, also went to Alfred Lamperez, 16, Catholic H.S., New Iberia, LA, for "Study of the Crowding Effects on Human Behavior"; Lisa Yarmoshuk, 15, Sir Winston Churchill Secondary School, St. Catherines, Ontario, Canada, for "Adventures in Stem Rooting: A Bibliographic, Experimental and Statistical Odyssey"; Dennis M. Palm, 18, Lane Technical H.S., Chicago, IL, for "Energy Autonomy by Solar and Bacterial Means"; Larry Scott Sherman, 17, Gompers Secondary School, San Diego, CA, for "Hormonal Regulation of Peripheral Gilal Tumor Growth in von Recklinghausen's Disease"; and

Donna Lou Borbury, 18, Middle Township H.S., Cape May Courthouse, NJ, for "Effects of Heavy Metals on Five Liver Enzymes in the Killifish"; Michael Shapiro Brandstein, 15, Woodbridge Senior H.S., Woodbridge, VA, for "On the Search for an Odd Perfect Number 2", and Bret Emerson Hursey, 17, James L. Mann H.S., Greenville, SC, for "Meteortic Impact Energy".

Meritorious Awards, consisting of Certificates of Achievement and silver medallions went to Thang Nguyen, 18, Huntsville H.S., Huntsville, TX; Kimberly Ann Webster, 17, Cocoa H.S., FL; Pinky Sajala Tiwari, 17, Trinity Episcopal Day School, Natchez, MS; Yvette Marie Barera, 18, Cor Jesu Academy, St. Louis, MO; Adrianna Martinez, 16, St. Pius X H.S., Albuquerque, NM; Michael David Randell, 17, Miami Coral Park Sr. H.S., Miami, FL; Charles Ray Barker, Jr., 17, Springdale H.S., Springdale, AR; Adam Richard Levine, 17, Midwood H.S., Brooklyn, NY; Tony Phillips, 17, Niceville Sr. H.S., Niceville, FL; Mark Richard Shires, 18, Nicolet H.S., Milwaukee, WI, Elaine G. Williams, 17, Hillcrest H.S., Springfield, MO; and Stephen Lorenzo Rozzi, 17, Reading Central Catholic H.S., Reading, PA.

Mrs. Anne G. Taylor, U.S. Army Research Office, Research Triangle Park, NC, was Army project officer for the ISEF program.

Anaclerio Picked for CSL Executive Training

Ms. Concetta Anaclerio has been selected as the 44th civilian employee to participate in the technical executive training program at the Chemical Systems Laboratory (CSL), Aberdeen Proving Ground, MD.

The program is designed to provide experience in staff work relating to management and provide experience for personnel expected to assume high technical and administrative positions.

Ms. Concetta Anaclerio

Anaclerio, chief of CSL's Technical Library, started her federal career in 1960 as a librarian assigned to Special Services for the Army in Europe. Since then she has served overseas in Germany, France, Vietnam, and in an assignment in Bethesda, MD. She came to CSL in 1977.

The CSL executive-training program includes a 3-month period in technical administration in the Office of the CSL Commander. Trainees then receive a similar period of training in the Office of the Deputy Chief of Staff for Research, Development and Acquisition, DA, Washington, DC.

Anaclerio was awarded a bachelor of science degree in chemistry by St. Johns University, in 1954, and received a master of library science degree from Columbia University in 1957.

She was the first librarian selected to represent the Army Materiel Development and Readiness Command when the Army Library Council was established in 1980.

500 Students Participate in S&E Program

Undersecretary of Defense for Research and Engineering Dr. Richard D. DeLauer has announced that more than 500 promising high school students are participating in this year's Department of Defense Science and Engineering Apprenticeship Program.

The program provides the students an opportunity to work in DOD laboratories or in laboratories under contract to the Defense Department.

Since the program began in 1980, more than 1,000 high school students have participated. Each student is assigned to a senior scientist or engineer who serves as the student's mentor in a one-on-one relationship. Students range in age from 14 to 18. More than 50 percent are women and other minorities.

Military departments administer and execute the apprenticeship program for DOD. Each military department has fully staffed, in-house labs and research activities which are able to accommodate the students.

In the Washington area, 158 of approximately 200 area students are part of the Joint Army-Navy National Capital Initiative in which the University of the District of Columbia works in conjunction with the Naval Research Laboratory and various Army labs. Over 1,000 students applied for the 158 positions.

One of the Washington students, Clarke Simmons, invented a laser system that the Army is patenting. Last year, 22 of the 40 Westinghouse science competition finalists enrolled in the Department of Defense program. Additional information may be obtained by calling (202) 692-7393.

Awards . . .

APG Wins Environmental Quality Award

The Department of the Army has announced that Aberdeen Proving Ground, MD, is the winner of the 1981 Secretary of the Army Environmental Quality Award.

The award is given annually in recognition of the Army installation which has conducted the most outstanding environmental protection program during the preceding calendar year. Aberdeen's outstanding achievements in the areas of air, water and noise pollution control; waste recycling; toxic and hazardous materials management and environmental training enabled the post to receive top honors over six other installations competing for the award.

Aberdeen was selected specifically for its design and operation of an extensive groundwater monitoring program which prevented toxic chemical contamination; the upgrade of its sewage treatment plant; the effectiveness of the installation in preventing fuel and chemical spills and its operation of a hazardous waste storage facility which the Maryland Department of Health has judged as one of the best facilities they have seen.

Aberdeen will be the Department of the Army's entry in the competition among all the services for the Secretary of Defense Environmental Quality Award.

Receiving the Army's first runner-up award for the fourth consecutive year was Fort McClellan, AL, which will also receive a special award for its consistently outstanding environmental programs. Second runner-up is Red River Army Depot, which received the Army's top environmental honor in 1979.

Mitchell Cited for Protective Cloth Efforts

Mr. Tom Mitchell, a textile engineer at the Army's Chemical Systems Laboratory (CSL) has received a $2,500 significant cash award for his successful efforts to provide an improved protective garment for the American soldier in a chemical environment.

A project officer in CSL's Physical Protection Division, Mitchell was recognized through the Army's Merit Pay Cash Award Program for adapting a commercial cloth material for use in military overgarments.

Tests to date have established the new material development, designated the Gore-Tex/Charcoal Cloth CB Laminated System, will be at least 45 percent cooler than the current standard Army permeable protective clothing.

The achievement vastly reduces a soldier's heat burden while wearing protective clothing and is considered a significant breakthrough in the development of body protection equipment.

The material development will be turned over to the Army's Natick Laboratories. Mitchell is responsible for CSL's technical developments related to special purpose protective clothing.

BRL Employees Praised for ORSA Work

Three research personnel at the Army's Ballistic Research Laboratory (BRL) have been recognized for noteworthy achievements in operations research and systems analysis.

The honorees are Dr. J. Terrence Kopcic and Dr. Judith K. Temperley, both research physicists, and Janet E. Lacetera, a mathematician.

Klopcic, who is assigned to BRL's Vulnerability/Lethality Division, was awarded the Army's Systems Analysis Award by both the Army Materiel Development and Readiness Command, and the Army Armament R&D Command (ARRADCOM).

He was cited for development of a residual combat capability methodology code, a unit level systems analysis tool used as an analytical approach to assess the vulnerability as well as the training and maintenance requirements of a broad spectrum of military units.

Temperley and Lacetera, who are both assigned to BRL's Ballistic Modeling Division, were recognized by ARRADCOM for their achievements in support of the Division Air Defense (DIVAD) Gun System Source Selection Board. (DIVAD has been formally named the Sergeant York Air Defense Gun, in honor of the World War I Medal-of-Honor winner.)

Aeronautics Institute Honors Dr. Murphy

Dr. Charles H. Murphy, chief of the Ballistic Research Laboratory's (BRL) Launch and Flight Division, has been honored by the American Institute of Aeronautics and Astronautics (AIAA) for his work in projectile studies.

Dr. Murphy was cited for authoring a state-of-art technology entitled, "Symmetric Missile Dynamic Instabilities," published in AIAA's *Journal of Guidance and Control.*

Author of more than 100 scientific publications, he received a BS degree in mathematics with honors from Georgetown University in 1947, and was awarded a master's degree in both mathemtics and aeronautics as well as a PhD degree in aeronautics from the Johns Hopkins University.

Dr. Murphy has been involved in projectile flight mechanics at BRL for more than 20 years. His work has included research on the Army's Copperhead projectile and setting the height record of 111 miles for gun launched projectiles.

Elected a "Fellow" of AIAA in 1981, for his expertise and contributions in the area of flight mechanics, Dr. Murphy received the 1976 AIAA Mechanics and Control Flight Award, and the prestigious BRL Kent Award in 1969. He also received the Army's Research and Development Achievement Award in 1979.

Ramsley Receives Natick TD's Gold Pin Award

Mr. Alvin O. Ramsley, an employee at the U.S. Army Natick Research and Development Laboratories, Natick, MA, was presented the 1982 Technical Director's Gold Pin Award for his research accomplishments in the development of the broad band woodland camouflage pattern for the new Army Battle Dress Uniform. The award is the highest Technical Award presented by the Laboratories to employees.

A major contributor to the development of broad band camouflage used by the combat soldier, Ramsley has been employed in the Individual Protection Laboratory at Natick since 1963. A supervisory research chemist within the Countersurveillance Section, Textile Research and Engineering Division, he is the author of 6 journal articles, 47 Technical Reports, holds 2 patents and is a member of several professional societies.

MERADCOM Developing New Bulk Fuel Delivery System

No matter how good vehicle and weapons systems are, they will not be able to maintain the fight if they run out of fuel. Getting fuel to the front lines has been and will continue to be one of the foremost concerns of Army logistics.

To provide a giant step forward, the U.S. Army Mobility Equipment Research and Development Command is developing the Pipeline Outfit, Petroleum System (POP) to carry the large bulk quantities of fuel inland from the beach entry forward to corps areas. When deployed, the POP will enable construction of up to 18 miles of 6-inch or 8-inch pipeline in a single day.

The key to the system is the pipe coupling equipment which consists of mechanical pipe joint, a hydraulic pipe joining press, and a pipe coupling collar.

The collar is machined on the inside diameter so that the fit when the pipe is inserted is an interference serrated thread inside the coupler grip to the pipe wall. An epoxy sealant is applied to the interior of the pipe before it is inserted into the collar.

Epoxy prevents galling during the assembly and once cured serves as a secondary seal. The pipe when procured, will have a collar already swedged (pushed) to one end of the pipe section. This will greatly speed assembly once the pipe sections are strung.

The hydraulic press has an aluminum structural frame with two vise bowls mounted to hold the pipe sections. One bowl is rigid relative to the frame and is used to clamp the end of the previously attached pipe with collar. The second bowl grips the male end of the pipe so that it can be swedged into the open end of the collar. This bowl rides on steel rods and uses hydraulic cylinders to force the male end into the collar.

The vise bowls are open and closed by hydraulic cylinders. The hydraulic press is controlled by a bank of five, 3-way directional valves. The hydraulic system of the tractor that transports it.

After the male end is swedged into the collar completing the joint, the bowls are opened, and kick rollers lift the jointed pipeline section out of the press. The press, which is carried by a side boom tractor is then moved forward. The entire cycle takes less than one minute; the system can join six- or eight-inch pipe, by simply exchanging the pipe grips in the vise bowls.

POP is a military adaptation of a commercial system used by major oil companies. The adaptation only is to use aluminum for the frame in place of steel to greatly reduce the weight and improve transportability. This does not affect the integrity of the system since the Army uses walled, lightweight pipe, which requires smaller joining force in comparison to the heavy pipe used in commercial systems.

The initial POP system was delivered by the contractor, ICO, Inc., of Odessa, TX, in Apr 82. Since then, the system is undergoing evaluation at Aberdeen Proving Ground by the Test and Evaluation Command. The unit will be user tested at Fort Pickett, VA, soon. Tests include laying 1½-miles of pipeline under tactical conditions.

Plans call for purchase of an additional system in FY83 for integrated logistic support evaluation. The decision on type classification is scheduled in FY83, and if affirmative, the system should be fielded in FY86.

MICOM Awards Pershing Contract

The U.S. Army Missile Command has announced the award of the first production contract for the Pershing II long-range missile system. Martin Marietta Aerospace, Orlando, FL, is receiving $104,971,000 for both missiles and ground support equipment.

Martin Marietta, prime contractor, previously received $87,000,000 for long lead time items to be used in the production program. Subcontractors, including Goodyear Aerospace, Bendix, Singer Kearfott, and Hercules, Inc., will share in the funding.

Pershing II is an evolutionary improvement to the Pershing 1A missile system now operational in Europe.

EDITORIAL

It has been the policy of this magazine since its inception not to editorialize, either by separate editorials or in the writing of its stories and articles. We are breaking this policy with this issue to call attention to what we believe is the growing insidious and practice of the unnecessary use of acronyms and over-titling by the U.S. military.

The editor of this magazine has been affiliated with the U.S. Army, in one way or another, since 1937, and never until recent years has he had a comprehension problem with the written military word. Our military language has always tended to be stiff, impersonal, often passive voiced, and noun-followed-by-adjective in style. But it was with few exceptions, understandable. A Truck, cargo, 2½ ton, 4×4, was easily understood for what it was. So was the U.S. Rifle, Cal. .30, M1. Titles were not fearsomely long things that tried to describe every aspect of the item and then be followed by a clap-trap acronym—such as (TRUCARG-4) and (USRIM-1).

Today it is an appalling experience to try to interpret a daily reading file, so ridiculous has the practice and habit become of inserting an acronym after every combination of three or more nouns and adjectives. When this reading-inhibiting factor is added to a long, ungainly and ultra-descriptive title or name, comprehension falls with a crash. One paper that came to our attention not long ago had 14 acronyms on one page!

The purpose of the written word is to communicate—thoughts, words, ideas, feelings, etc., from one party to another. The editors of this magazine believe too much of today's military writing is failing to do this as well as it should for just three reasons, yet the capability to do better is inherent in the educational level of those who write much of this bad language.

Too many today feel that this style is the correct and accepted one, the one required of them by their superiors. In some cases there is no doubt a bit of the ego involvement; one is saying through the use of this stilted language, covertly, what an expert he is in a given field—to the ignorance of the reader. It is a perception that must strike some readers of this gobbledegook. The bottom line is that even if it doesn't antagonize, it fails, or hinders at best, to convey the real purpose of making the reader read easily and readily understand the message.

Those in the printed media business—where the most economical use of every inch of space is critical, can understand full well that there are times when abbreviations are vital. Our magazine title is a case in point. We realize that the computer has dictated language abbreviations. BUT, there is a time and a place.

The editorial policy of this magazine over the past four years has been to edit out acronyms from our stories wherever we could do so without danger of harming the meaning. We substitute a simple lower case title or part of the title or use a pronoun that is clearly relatable. We believe this practice has helped readability and comprehension of our content and we intend to continue this practice.

We earnestly hope that those in authority will take necessary steps to curtail the defeating practice of over-use of acronyms and stilted titles. As a start, perhaps our readers will join us in waging war on this harmful and dumb trend by curbing its use in their own writing.

The Editors

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